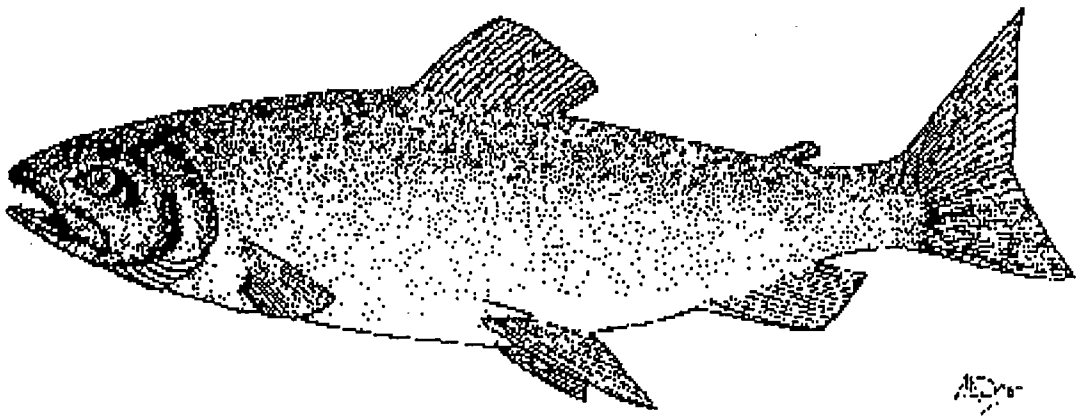
King County Levee and Revetment

Monitoring Training



Provided by
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Introduction

Thank you for allowing the U.S. Fish and Wildlife Service (Service) the opportunity to share our knowledge and skills involving monitoring techniques. We feel monitoring is a key component of any project. With the current ESA listing of chinook salmon in Puget Sound, it is important that projects are constructed as fish friendly as possible. Monitoring will give us some insight into whether the projects are providing a salmonid habitat component that appears to be lacking in urban rivers.

Our goal is to provide King County personnel with the skills and knowledge to conduct their own monitoring on current and future projects as required by the ESA. Over the next three days we will conduct training on habitat classifications and measurements, seining and snorkelling techniques, and juvenile salmonid identification.

Your instructors come to you with a variety of experiences and expertise in monitoring and salmon biology.

Roger Peters- Roger has a Ph.D. from the University of Washington and has worked for the Service for about 6 years. Roger has conducted research on salmonid habitat selection in the Clearwater River and is one of the co-authors of *Seasonal Fish Densities Near River Banks Treated With Various Stabilization Methods.* Roger also is a member of several salmonid habitat advisory boards within the Dungeness Watershed.

Brian Missildine- Brian has a B.S. in salmonid ecology from The Evergreen State College. Brian has worked for the Service for about 3 years. Brian managed a private salmon hatchery on the Satsop River before joining the Service. He is also a co-author of *Seasonal Fish Densities Near River Banks Treated With Various Stabilization Methods.* Brian currently provides technical assistance to Long Live the Kings in the Wishkah watershed. He also is part of a technical committee advising King County on the Snoqualmie and Tolt Rivers dredging and river bar scalping.

David Low-Dave has a B.S. in marine biology from Oregon State University. Dave's field experience is very extensive. He has been a member of research teams from Antarctica to the coast of Oregon. David is currently developing metrics for the Benthic Index of Biotic Integrity (BIBI) in large rivers. He too is a co-author of *Seasonal Fish Densities Near River Banks Treated With Various Stabilization Methods.*

Syllabus

Monday

9:30-9:45	Introductions and overview
9:45-10:00	River Safety
10:00-12:00	Methodology (habitat classification, statistics, fish identification)
12:00-1:00	Lunch
!:00-4:00	On river. Habitat classification and measurements.

Tuesday

9:00-12:00	Hamikami site. More habitat (NOTE START TIME)
12:00-1:00	Lunch (Bring with you)
1:00-4:00	Snorkel surveys, fish identification. Finish habitat measurements if needed.

Wednesday

9:00-12:00	Green River. Seining techniques
12:00-1:00	Lunch
1:00-4:00	Finish seining techniques. Wrap-up. Question and answers.

Please feel free to ask any questions at anytime. Make sure to bring snorkel gear Tuesday and Wednesday.

Habitat Classification

We use a five level hierarchical habitat classification system. This system is based on modifications of the habitat classification system described by Hawkins et al. (1993). The first level classification will identify the channel type as main channel, braided channel, side channel, slough (main channel/side channel), and tributary mouths (Table 1). Levels 2 through 4 will classify the main geomorphic units (pools, riffles) of the channel, and level 5 will classify secondary units within the primary geomorphic units (Table 2). For level 2 the water is simply classified as deep or shallow in confined and straightened rivers. Level 3 further separates these two classes as turbulent riffle or non-turbulent riffle, and scour pool or dammed pool. Level 4 further divides these groups. For example, turbulent riffles can be classified as falls, cascades, rapids, riffle, or chute, and scour pools can be classified as eddy, lateral, mid-channel, trench, convergence, or plunge. Level 4 terminology will be used again for level 5 to describe secondary habitat units. These level 5 units must be 20% of the wetted channel width wide and/or long. It is possible to have fast water level five classifications within a slow water level four classification and vice versa.

We measure habitat length, width, average flow, maximum and average depth, bank angle, percent overhead riparian cover, vegetation overhang, undercut banks, sediment composition, and length and width of available cover for each level 5 habitat class (Table 3). Flow is measured using a swouffer model 2000 current meter at 60% of the total depth. The flow should be taken in an area the represents the average flow for that habitat based on visual observation. Depths is taken using a stadia rod and will be recorded to the nearest 0.1 m. Bank angle is measured by measuring the distance from the waters edge out to the channel toe (along a horizontal plane) and the water depth at that point. Undercut banks will have bank angle values of greater than 90 degrees. Percent overhead riparian cover is estimated visually. Vegetation overhang is estimated visually as the percentage of the bank with vegetation within 30 cm (1 ft) of the water surface. Undercut banks are measured using a stadia rod. Sediment is scored based on the size of the dominant and subdominant substrates and substrate embeddedness. Four scores will be recorded for sediment scores. The size of the dominant and subdominant sediments are scored based on Table 3. The size of the sediment around the dominant sediment will be scored using this same scale. Finally, embeddedness of the dominant substrate is recorded using the embeddedness score listed in Table 3. Each cover component (Table 4) is measured for length and width using a stadia rod and is measured to the nearest 0.5 m and visually classified as complex, medium, or sparse with regard to cover provided for rearing fish.

Table 1. Description of level 1 habitat classifications for this study (Adapted from Murphy et al. 1989; Hirchi and Reed 1998).

Habitat Type	Description
Main channel	areas of main river
Braided main channel	(2 or more channels separated by bar or bars which lack vegetation or are sparsely vegetated with immature trees.
Side channel	channel separated from main channel by well vegetated riparian woodlands
Overflow channels	small channels that inter-connect a side channel to the main channel
Tributary mouth	Mouth of a tributary stream entering the main channel
Slough (main channel/side channel)	slough formed when sediment and organic debris block the head of a braid or branch of a main channel (very slow water velocity)

Table 2. Description of four level hierarchical meso-habitat classification system to be used for this project (Modified from Hawkins et al. 1993)

Level 2	Level 3	Level 4 & 5	Description
Shallow Water			riffles; rapid, shallow stream sections with steep water surface gradient (McMahon et al. 1996)
	Turbulent		Channel units having swift current, high channel roughness (large substrate), steep gradient, and non-laminar flow and characterized by surface turbulence.
		Fall	steep vertical drop in water surface elevation
		Cascade	series of alternating small falls and shallow pools, usually boulder, bedrock
		Rapid	deeper stream section with considerable surface agitation and swift current; large boulders and standing waves often present.

Level 2	Level 3	Level 4 & 5	Description
		Riffle	shallow, lower-gradient channel units with moderate current velocity ans some partially exposed substrate (usually cobble).
		Chute	narrow, confined channel with rapid, relatively unobstructed flow and bedrock substrate.
	Non-Turbulent		channel units having low channel roughness, moderate gradient, laminar flow, and lack of surface turbulence.
		Sheet	shallow water flowing over smooth bedrock
		Run	shallow water flowing over a variety of different substrates; also termed "glide" or "raceway" by some authors.
Deep Water			
	Scour Pool		formed by scouring action of current
		Eddy	formed by circular current pattern created by bank obstruction, usually occur along the bank
		Trench	formed by scouring of bedrock. Usually located in the main channel
		Mid-Channel	form in the main channel by channel constriction at the head of the pool
		Convergence	form in the main channel by converging streams
		Lateral	formed in the main channel where flow is deflected by a partial channel obstruction (streambank, rootwad, log, or boulder); for example at the outside bends in the channel of meandering streams, deeper on one side than the other and form as a result of a deflector at the head of the pool
		Plunge	form in the main channel, deeper upstream, and are formed by water dropping vertically over a channel obstruction
		Deposition	Depositional area within a scour pool. Usually along the point bar of a lateral scour pool.
	Dammed Pool		water impounded by channel blockage
		Debris	formed by rootwad and logs

Level 2	Level 3	Level 4 & 5	Description
		Beaver	formed by beaver dam
		Landslide	formed by large boulders
		Backwater	formed by obstructions along banks
		Abandoned Channel	formed alongside main channel, usually associated with gravel bars
		Convergence	form in the main channel by converging streams

Table 3. Sediment scores for different sized and embedded substrates.

Rank	Characteristics
Particle type/size for dominant, subdominant, and size around dominant	
1	Organic cover (<50% of bottom)
2	<1-2 mm
3	2-5 mm
4	5-25 mm
5	25-50 mm
6	50-100 mm
7	100-250 mm
8	> 250 mm
Embeddedness (extent to which dominant substrate is covered by finer sediments	
1	100%
2	75%
3	50%
4	25%
5	unembedded

Table 4. Description of the cover elements to be used for this project.

Cover Type	Description
Boulder	Rock >=256 mm
Bedrock	Exposed solid rock
Cobble	Rounded rocks 64-256 mm
Deep water	Water depths >1m (other cover takes precedence)
Vegetation	Live, terrestrial vegetation
Plants	Live, non woody aquatic vegetation
Pilings	Vertically driven logs
Riprap	Angular boulder sized rock placed for bank protection
Rubble	Angular cobbles sized rock placed for bank protection
Undercut banks	Submerged area underneath an overhanging bank
Wood	Woody debris of various types
Anchored brush	Branches of non-tree woody plants hanging in the water
Branch	Woody debris < 20 cm in diameter, not accumulated in debris piles
Bank roots	Roots of live trees and shrubs in the water
Debris piles	Numerous or single types of wood cover accumulated in a pile or jam
Single log	Woody debris > 20 cm diameter, not accumulated in debris piles
Rootwad	Roots and lower trunk of non-growing trees
No Cover	Substrate is < cobble size, depth is < 1.0 m, and none of the above present.

Habitat classification.

Level 1	Level 2	Level 3	Level 4	Level 5
Main channel (MC)	fast water shallow water (FWSW)	turbulent (TUR)	fall (FA)	fall (FA)
Braided main channel (BC)	fast water deep water (FWDW)	non turbulent (NT)	cascade (CA)	cascade (CA)
Side Channel (SC)	slow water shallow water (SWSW)	scour pool (SP)	rapid (RA)	rapid (RA)
Overflow channel (OC)	slow water deep water (SWDW)	dammed pool (DP)	riffle (RI)	riffle (RI)
Tributary mouth (TM)			chute (CH)	chute (CH)
Slough (SL)			sheet (SH)	sheet (SH)
			run (RN)	run (RN)
			eddy (ED)	eddy (ED)
			trench (TR)	trench (TR)
			mid channel (MC)	mid channel (MC)
			convergence (CV)	convergence (CV)
			lateral (LT)	lateral (LT)
			plunge(PP)	plunge(PP)
			deposition (DEP)	deposition (DEP)
			tail out (TO)	tail out (TO)
			debris (DB)	debris (DB)
			beaver (BV)	beaver (BV)
			landslide (LS)	landslide (LS)
			backwater (BW)	backwater (BW)
			abandoned channel (AC)	abandoned channel (AC)

Statistics/Experimental Design

The experimental design for the levee/revetment repair will consist of sampling each repair site and a representative control (sites that will not be altered) before and after repair. Sampling will occur on a seasonal basis, with a survey being completed in late-summer, winter, and spring. Two different comparisons can be completed depending on how many different methods are used to repair the levees. A paired t-test could be used to compare actual fish densities if only one repair method is used. If more than one repair method is used, than relative fish densities would be compared using analysis of variance.

Relative fish densities and habitats can be calculated for each site and compared using either a paired t-test or an analysis of variance (ANOVA). This test will depend on how many different repair methods are used.

We use the bounded count methodology for estimating fish abundance (Regier and Robson 1967). The estimated for fish abundance are calculated as follows:

$$N=2N_m - N_{m-1}$$

where N is the estimate of fish abundance, N_m is the largest count, and N_{m-1} is the second largest count. This is typically done with three snorkellers.

Densities for comparison between control and study sites are calculated as follows:

Revetment density (D_r) = fish count / revetment length

Control Density (D_c) = fish count/control length

And:

Reach density (R_d) = C_r+C_c/L_r+L_c

Where C_r and C_c are the revetment counts and control counts respectively; and L_r and L_c are the reach length and control length.

Relative densities are then calculated as:

Revetment relative density = $(D_r-R_d)/R_d$

Control relative density = $(D_c-R_d)/R_d$

The relative value is between -1 and infinity. The negative value would indicate lower than average density, and a positive value would indicate greater than average densities.

In areas with poor visibility alternate methods such as seining or minnow traps will be used. Catch per unit effort (CPUE) will be used as the data point for each of these methods. Most likely we will be using either a beach seine or a pole seine. A beach seine consist of a lead line, a cork line, and usually has a capture bag in the middle. Beach seines are set in a semi-circle around the target area and is hauled onto the beach. The net can be set by two people or by boat. A pole net has two poles and is maneuvered by two people around the sampling area. This method works well when there may be obstacles in the water or the monitoring is occurring in shallow water. Minnow traps or pot gear are most effective at capturing bottom-dwelling species looking for food or shelter. The fish must pass through a conical shaped funnel which makes it difficult to escape. The minnow trap is tied off to stable structure on the shore and then tossed out into the water where the monitoring is occurring.

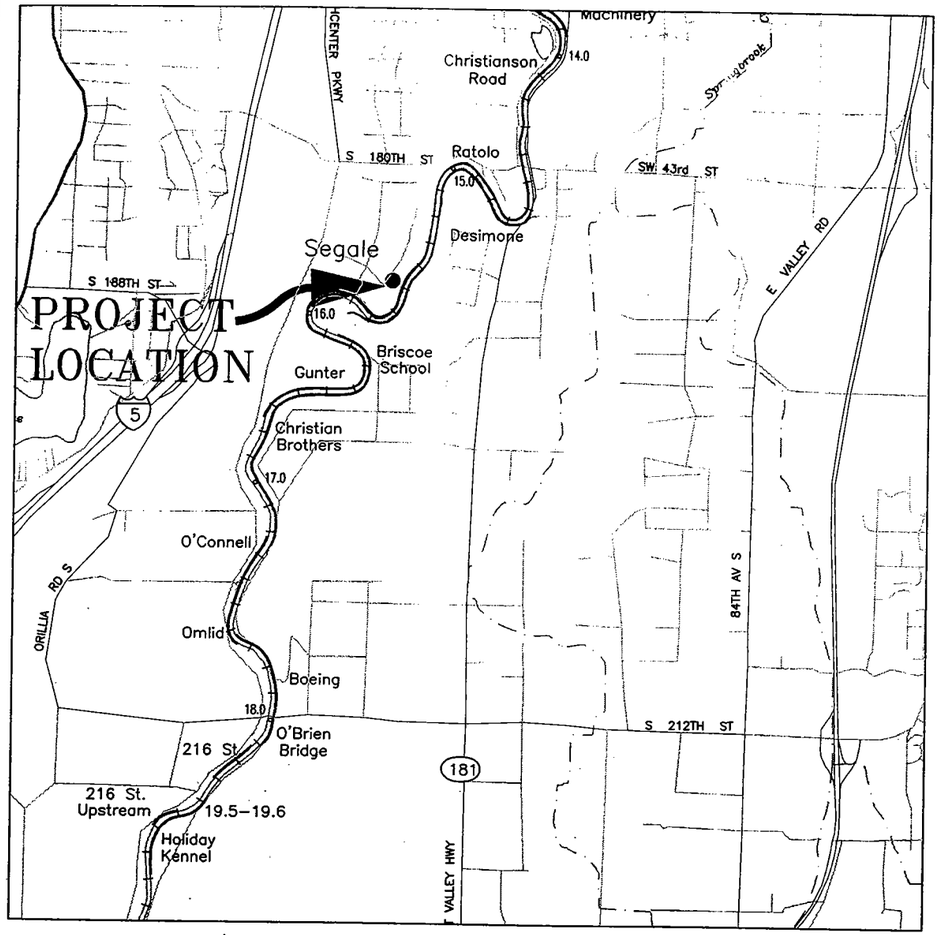
References Cited

Hawkins and 10 Co-authors. 1993. A hierarchical approach to classifying stream habitat features. Fisheries 18(6):3-12.

Murphy, M.L., J. Heifetz, J.F. Thedinga, S. W. Johnson, and K.V. Koski. 1989. Habitat utilization by juvenile Pacific salmon (*Oncorhynchus*) in the glacial Taku River, southeast Alaska. Can. J. Fish. Aquat. Sci. 46:1677-1685

Regier, H.A., and D.S. Robson. 1967. Estimating population number and mortality rates. Pages 31-66 *in* S.D. Gerking, editor. The biological basis of freshwater fish production. Blackwell Scientific Publications, Oxford, UK.

SEGALE
LEVEE TOE REPAIR
GREEN RIVER
RIVER MILE 15.45 LEFT BANK



LOCATION MAP

Temporary Erosion and Sediment Control (TESC):

The following will be brought to the site and staged on a daily basis as needed:
Straw bales for slope mulching
Silt fencing for perimeter siltation control
Crushed or washed rock for control of soil pumping on exposed soils in heavy traffic areas
5/8 inch minus crushed rock for staging areas and road shoulders
Pea gravel for filter berms and silt fence installations
Hand brooms, street sweepers, and wash trucks for control of sediments on paved traffic surfaces

A turbidity curtain will be installed at the site prior to in-water construction.

All in-water construction will occur between June 15 and August 15, 2001, to avoid extended periods of rainy weather and high river discharge, and to coincide with the period of minimum habitat utilization by juvenile and adult salmonids.

All paved traffic areas will be kept free from sediment accumulations by daily sweeping and washing.

Turbidity will be monitored at the construction site, at flagged sampling stations 50 feet upstream from the excavation area and 250 feet downstream from the excavation area to facilitate compliance with limits on turbidity set forth in Washington Department of Ecology Order No. DE 97WQ-007 (February 24, 1997), and at a flagged sampling station located one mile downstream from the site.

Construction Sequence; Toe and Bank Repair:

1. Stake limits of construction area at site.

2. Trench silt fence into riverbank slope, at lower limit of construction bench.

3. Place pea gravel berm to anchor silt fence into trench.

4. Excavate upper ten vertical feet of existing levee fill to create construction equipment access bench landward of silt fence.

5. Stockpile excavated materials landward of existing levee downstream of project area, onto pea gravel stockpile storage base.

6. Shape ramps to access equipment bench from existing levee crest upstream and downstream of bench area.

7. Starting at downstream project limits, construct toe repairs in fifteen foot long (maximum) increments, as follows:

8. Lay willow shoots flat against slope and anchor in place with sandbags to prevent damage from equipment. Prune shoots only if needed to prevent breakage.

9. Install floating turbidity curtain.

10. Operating from the temporary construction bench using a PC-330 excavator, excavate localized pockets of failed or displaced toe materials to accommodate large (four- to six-man) toe rocks.

11. Immediately place six inches of crushed railroad ballast bedding over exposed silts and sands.

12. Place eight inches of quarry spalls over ballast for additional bedding.

13. Place one foot of light-loose riprap over quarry spalls for additional bedding.

14. Secure one-inch diameter anchor chain onto large (four-to-six-foot diameter) rock, using drill holes from quarry.

15. Set four to six foot diameter toe rocks into bankline and wedge into place with additional large rock and heavy-loose riprap. Alternate every other toe rock with anchor rock secured to chain. Pack top edge of rock toe with quarry spalls and railroad ballast to match existing bankline.

16. Gently lower LWD pieces (with rootwads attached) into the water parallel to the bank and secure them to the toe rock anchor chains as shown on the project drawings. Secure logs to anchor chains, starting at the downstream end and proceeding upstream. Overlap cut log ends riverward of the next rootwad protruding downstream and secure overlapped logs to each other with additional one-inch diameter anchor chain. To the maximum extent, anchoring of the LWD should seek to secure the logs as far below the OHWM as practical, while minimizing the potential for individual logs to and become lodged on the bankline, during flood events. Precise placement of individual LWD pieces will be accomplished under the supervision of the project engineer and the Senior Ecologist.

17. Repeat in next upstream increment to end of repair project area.

18. Install additional native willow and dogwood cuttings to repair any incidental disturbance of existing willow layers (installed in 1996).

Construction Sequence; Levee crest reconstruction:

1. Replace stockpiled levee fill materials onto bench area to reconstruct levee prism to original height. Compact in eight inch lifts to 95 % maximum density at optimal moisture content.

2. Bring the levee slope face as close as possible to finish grade and mulch with straw on a daily basis as needed during any anticipated periods of rainy weather. Finish grading upper bank slope.

3. Reserve one to three feet of fill depth along both landward and riverward levee face for placement of planting soil. Place soil as shown on cross-section drawing. Dress finished levee face slope with one to three feet of an approved planting soil mix with a minimum 20% amendment of "Groco" as needed to support riparian vegetation establishment and hydroseed immediately following completion.

4. Stake slope areas subject to winter inundation with coir fabric over the completed hydroseed cover as needed to prevent winter erosion.

5. Hydroseed any remaining disturbed soil surfaces following completion of all construction activities.

6. Remove turbidity curtain.

7. Water plants and grass seed as needed, twice a week minimum, until the onset of fall rains.

8. Once grass cover is established and thriving, remove silt fence, hand smooth trench area to distribute pea gravel over disturbed soils along length of trench, hand seed, and cover with straw mulch.

9. Add additional plantings to willow layers above toe during the following plant dormancy season (October1 through March 31).

10. Plant middle and upper slope areas with potted upland native shrubs during the following plant dormancy season (October 1 through March 31) in accordance with planting plan and plant schedule shown on the project drawings.

Equipment Used: PC 330 track hoe, D-3 bulldozer, 10 CY dump trucks, flatbed willow and watering trucks, pickup trucks, 1 ton flatbed trucks, 30' bed trash hauler, portable water pump and/or water truck, hydroseed truck, vibratory roller/compactor.

Long Term ESC Monitoring: Post-construction ESC monitoring will be accomplished as follows:

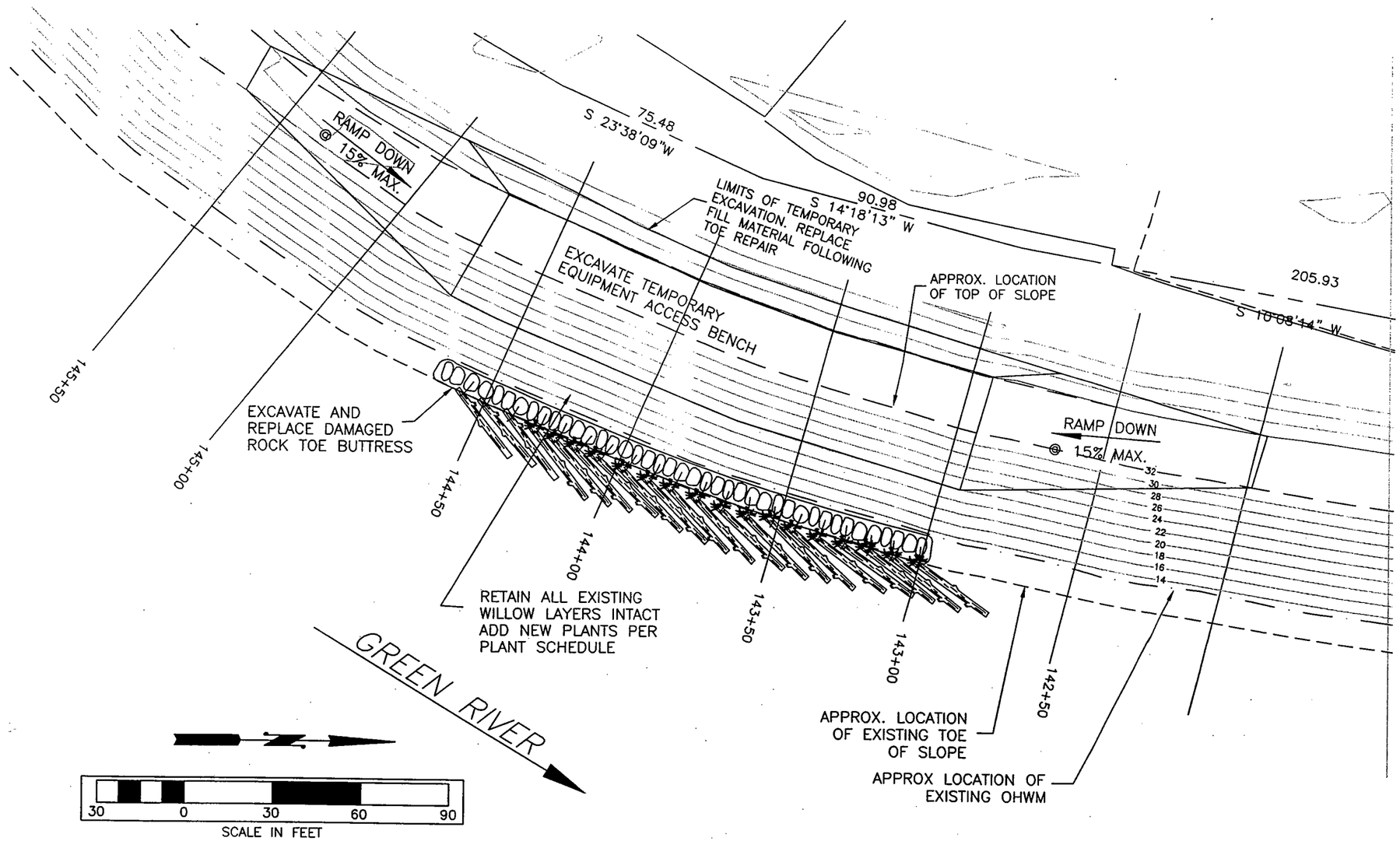
All stabilized slope areas will be monitored for signs of erosion during wet winter months and immediately repaired. Repairs can include straw mulching, straw mulch packing of incipient rills, gravel patching of incised rills, additional placement of topsoil, additional hand- and/or hydroseeding, additional installation of willow & dogwood live cuttings and/or potted native riparian shrubs, placement of washed rock filter berms, and localized placement of additional silt fencing. The goal is to maintain a vigorous establishment of dense, deeply rooted erosion control grasses and native riparian vegetation on all disturbed slope areas at all times.

SURVEYED: KC RIVERS				PROJECT MANAGER: ANDY LEVESQUE DATE: 12-22-00	PROJECT No. 089514
BASE MAP PLOT:				PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 12-22-00	
DESIGN PLOT:				DESIGNED: ANDY LEVESQUE DATE: 12-22-00	
CHECKED:				DRAWN: EDNA MACKINNON DATE: 12-22-00	
FIELD BOOK:					
BY	DATE	REVISION	BY	DATE	

KING COUNTY DEPT. OF NATURAL RESOURCES
PAM BISSONNETTE, DIRECTOR
WATER AND LAND RESOURCES DIVISION
SEGALE LEVEE TOE REPAIR
GREEN RIVER, RIVER MILE 15.45 L.B.
COVER

SHEET 1 OF 4 SHEETS

RIVERS SECTION



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BASE MAP PLOT:				PROJECT ECOLOGIST: R. SCHAEFER	DATE: 12-22-00			SEGALE LEVEE TOE REPAIR	
DESIGN PLOT:				DESIGNED: A. LEVESQUE	DATE: 12-22-00			GREEN RIVER, RIVER MILE 15.45 L.B. PLAN VIEW	RIVERS SECTION
CHECKED:				DRAWN: E. MACKINNON	DATE: 12-22-00				
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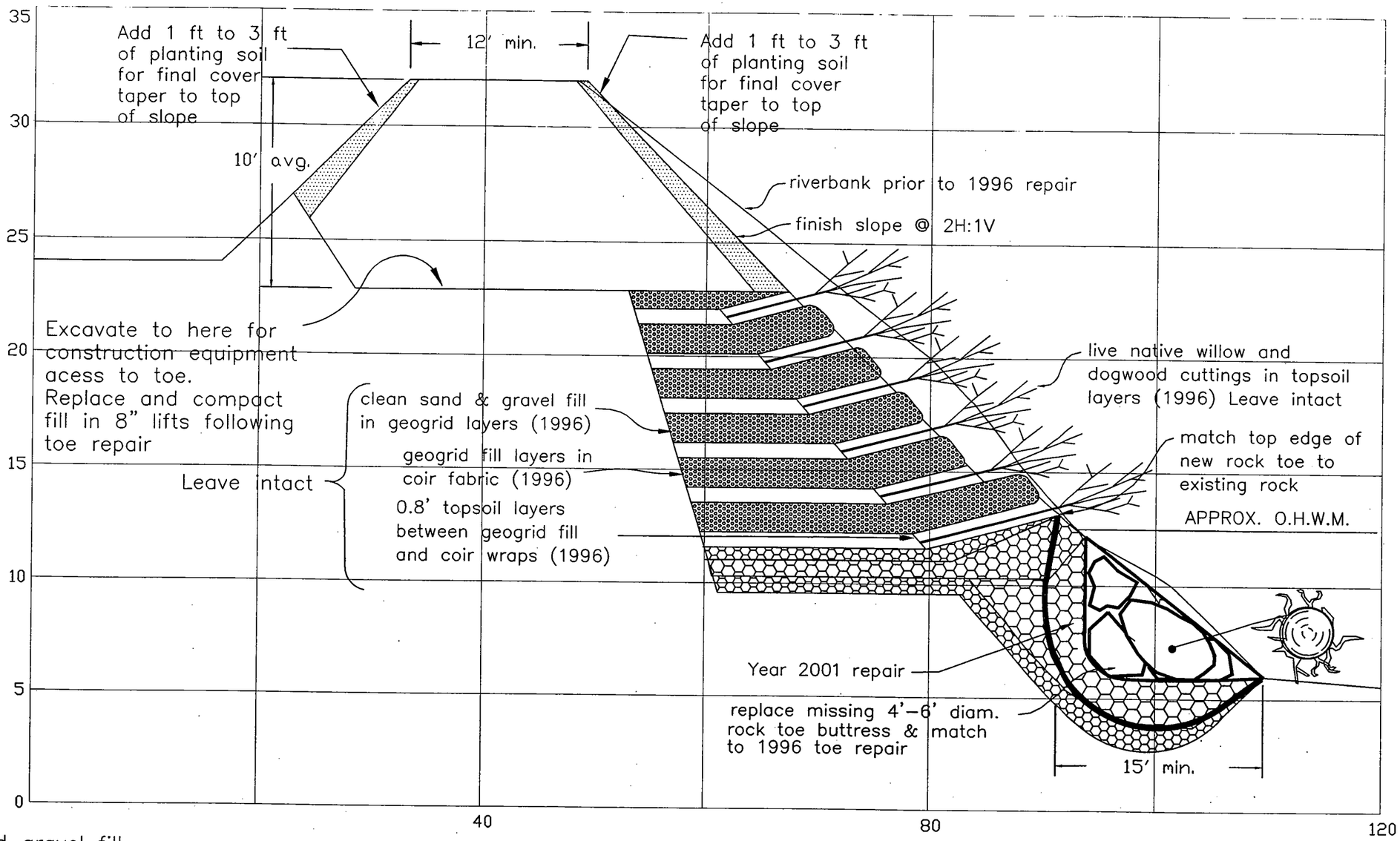


clean sand and gravel fill

2"–8" quarry spalls

light–loose rip–rap

heavy loose rip–rap

SEGALE LEVEE TOE STABILIZATION
TYPICAL CROSS SECTION

SCALE

horiz. 1 inch = 10 feet

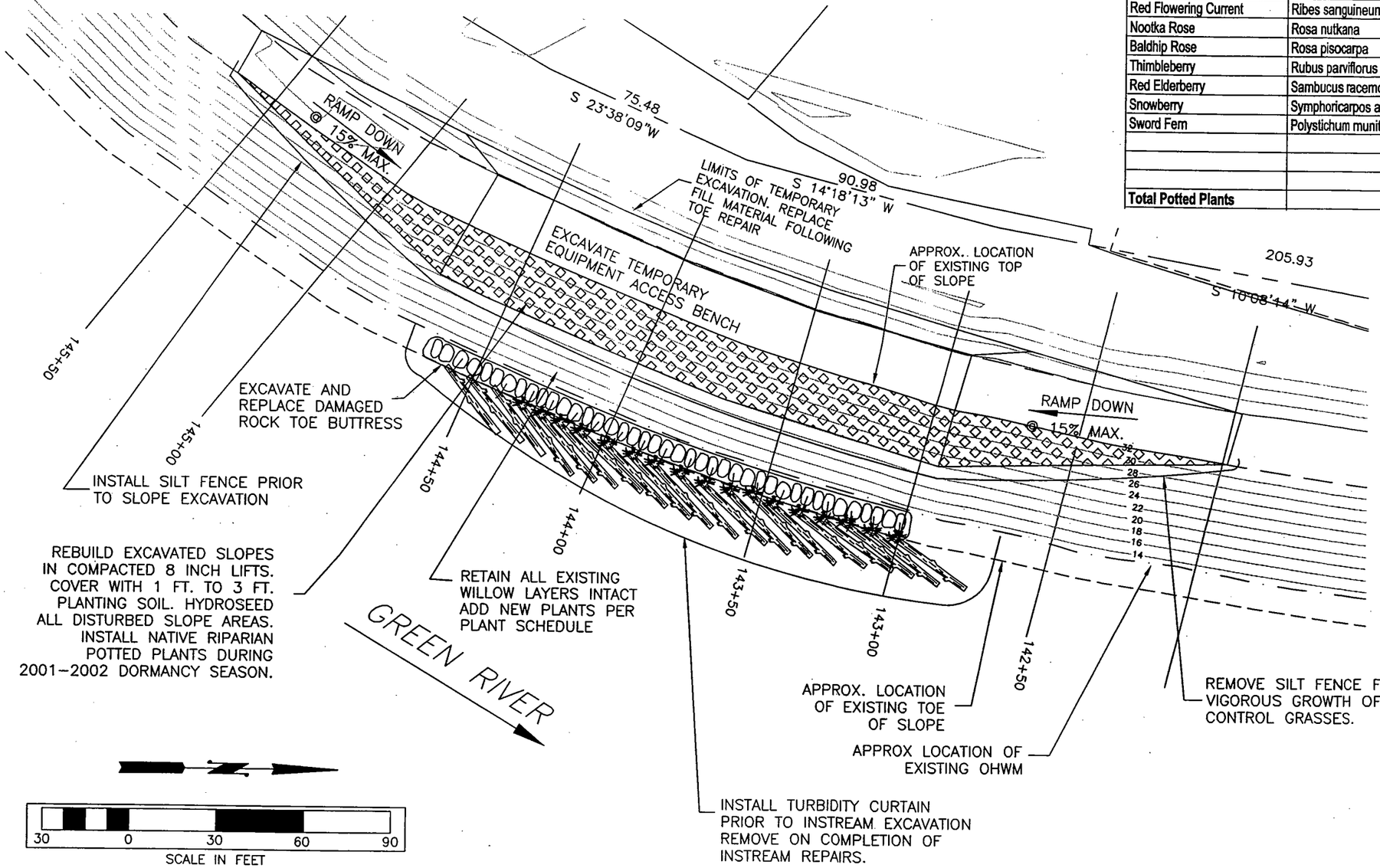
vert. 1 inch = 5 feet

SURVEYED:				PROJECT MANAGER: A. LEVESQUE	DATE: 12-22-00		KING COUNTY DEPT. OF NATURAL RESOURCES PAM BISSONNETTE, DIRECTOR WATER AND LAND RESOURCES DIVISION SEGALE LEVEE TOE REPAIR GREEN RIVER, RIVER MILE 15.45 L.B. TYPICAL SECTION VIEW	SHEET 3 OF 4 SHEETS
BASE MAP PLOT:				PROJECT ECOLOGIST: R. SCHAEFER	DATE: 12-22-00			
DESIGN PLOT:				DESIGNED: A. LEVESQUE	DATE: 12-22-00	PROJECT No.		
CHECKED:				DRAWN: E. MACKINNON	DATE: 12-22-00			RIVERS SECTION
DATUM:								
BY DATE	REVISION	BY	DATE					

SEE COVER SHEET FOR PROJECT NOTES INCLUDING:
TEMPORARY EROSION AND SEDIMENT CONTROL
CONSTRUCTION SEQUENCES
LONG TERM EROSION AND SEDIMENT CONTROL
MONITORING

SEGALE LEVEE REPAIR PLANT SCHEDULE

Common Name	Species Name	Typical Pot Size	Approx. Spacing	Upper Bank
Serviceberry	Amelanchier alnifolia	1 gallon	4'+	83
Western Hazelnut	Corylus comutus	1 gallon	4'+	83
Black Hawthorn	Cratageus douglasii	1 gallon	4'+	83
Oceanspray	Holodiscus discolor	1 gallon	4"+	83
Red Flowering Current	Ribes sanguineum	1 gallon	3'+	43
Nootka Rose	Rosa nutkana	1 gallon	3'+	43
Baldhip Rose	Rosa pisocarpa	1 gallon	3'+	43
Thimbleberry	Rubus parviflorus	1 gallon	4'+	43
Red Elderberry	Sambucus racemosa	1 gallon	4'+	630
Snowberry	Symphoricarpos alba	1 gallon	4'+	83
Sword Fern	Polystichum munitum	1 gallon	2'+	43
Total Potted Plants				1260



UPPER BANK

Est. 5350 sq. ft.

30 0 30 60 90
SCALE IN FEET

SURVEYED:				PROJECT MANAGER: A. LEVESQUE DATE:		KING COUNTY DEPARTMENT OF NATURAL RESOURCES PAM BISSONNETTE, DIRECTOR WATER AND LAND RESOURCES DIVISION SEGALE LEVEE TOE REPAIR TEMPORARY EROSION AND SEDIMENT CONTROL PLAN	SHEET 4 OF 4 SHEETS
BASE MAP PLOT:				PROJECT ECOLOGIST: R. SCHAEFER DATE:			
DESIGN PLOT:				DESIGNED: A. LEVESQUE DATE:			
CHECKED:				DRAWN: E. MACKINNON DATE:	PROJECT No. 089514		RIVERS SECTION
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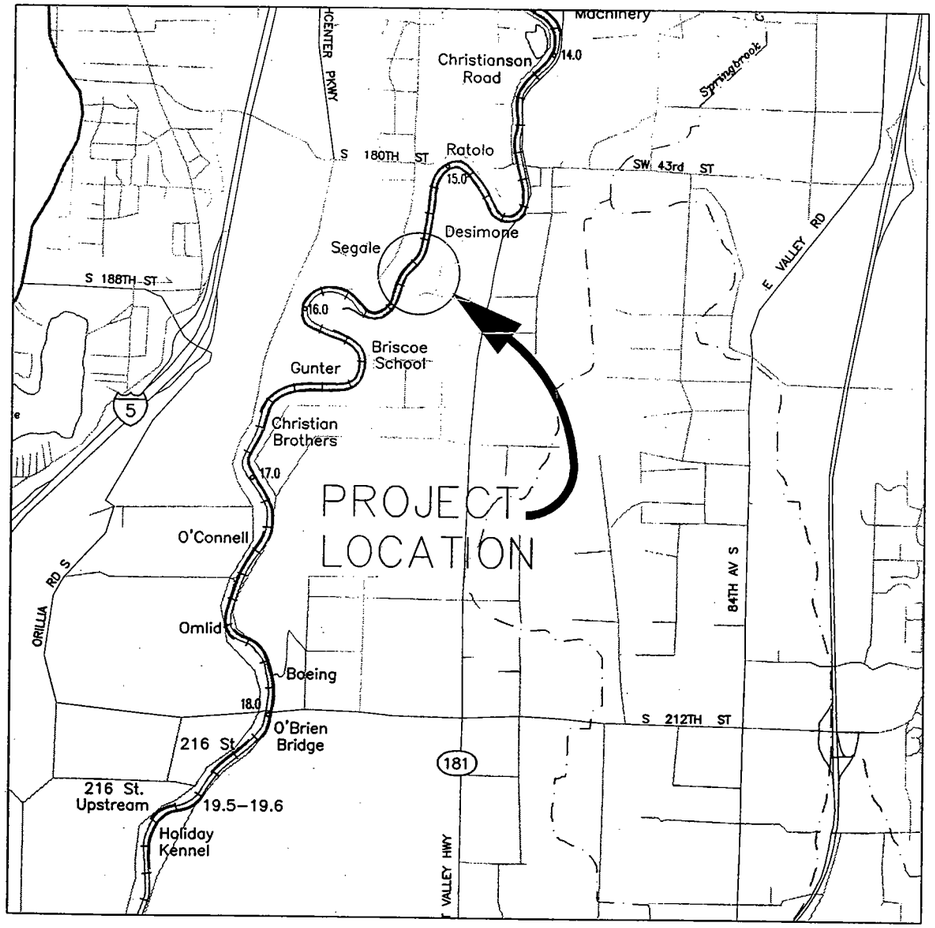
DESIMONE LEVEE TOE REPAIR

GREEN RIVER, RIVER MILE 15.45 RIGHT BANK



LOCATION MAP

Desimone Levee Repair (proposed for construction in 2001)

Temporary Erosion and Sediment Control (TESC):

- The following will be brought to the site and staged on a daily basis as needed:
- Straw bales for slope mulching
- Silt fencing for perimeter siltation control
- Crushed or washed rock for control of soil pumping on exposed soils in heavy traffic areas
- 5/8 inch minus crushed rock for staging areas and road shoulders
- Pea gravel for filter berms and silt fence installations
- Hand brooms, street sweepers, and wash trucks for control of sediments on paved traffic surfaces.

- An undisturbed band of existing vegetation will be left intact along the waterline until excavation of failed or damaged toe buttress areas for installation of crushed rock bedding, toe rock, LWD anchor rocks, and LWD.

- A turbidity curtain will be installed at the site during in–water construction.

- All in–water construction will occur between June 15 and August 15, 2001, to avoid extended periods of rainy weather and high river discharge, and to coincide with the period of minimum habitat utilization by juvenile and adult salmonids.

- All paved traffic areas will be kept free from sediment accumulations by daily sweeping and washing.

- Turbidity will be monitored at the construction site, at flagged sampling stations 50 feet upstream from the excavation area and 250 feet downstream from the excavation area to facilitate compliance with limits on turbidity set forth in Washington Department of Ecology Order No. DE 97WQ–007 (February 24, 1997), and at a flagged sampling station located one mile downstream from the site.

Construction Sequence; Toe and Bank Repair:

1. Stake limits of construction area at site.

2. Shape ramps to access bench from existing levee crest upstream and downstream of bench area.

3. Operating from the levee bench, detach the LWD rock anchor chains from the poplars previously staged on the low bench.

4. Starting at the downstream project limits, install the floating turbidity curtain in 175–foot–long increments to isolate the instream work area(s) from the flowing stream.

5. Starting at downstream project limits, construct toe repairs in fifteen foot long (maximum) increments, as follows:

6. Starting at the downstream end of the project, clear and grub existing blackberries and reed canarygrass from the lower bank slope, above the OHWM, in 15 foot increments. Export these plant and soil materials to an approved disposal location (Pacific Topsoil site in Kent or King County Roads Division soil recycling center in Renton).

7. Excavate existing failed levee rip–rap and unsuitable subgrade materials from the lower embankment slopes, above the water surface elevation, in the same 15 foot increments. Export these materials to an approved disposal location (Pacific Topsoil site in Kent or King County Roads Division soil recycling center in Renton).

8. Excavate failed or damaged toe buttress areas and unsuitable subgrade materials from below the water surface elevation for placement of new crushed rock bedding, toe rock, and LWD anchor rocks, in the same 15 foot increments. Working from the embankment side toward the water's edge, leave an intact earthen "plug" at the riverward edge of the toe rock and LWD anchor rock excavation area until the moment of actual toe buttress bedding and rock placement in order to minimize turbidity.

9. Excavate and remove the earthen "plug" from along the water's edge, completing the excavation to depth as rapidly as possible. Immediately place 2–1/4" crushed railroad ballast and quarry spalls to stabilize the exposed riverbed and embankment soils, and to provide suitable bedding conditions for placement of toe and LWD anchor rock. Complete this work within the same 15 foot increments.

10. Place rock LWD anchors within the prepared toe buttress bedding area at a 25 foot spacing, with anchor chains already attached to quarry holes drilled in the rock. Place additional toe buttress rocks in place to firmly secure the LWD anchors in place, and to secure the entire toe buttress against undercutting erosion, working within the same 15 foot increments as above. Level the top edge of the rock toe buttress at a finished elevation approximately one foot above the OHWM, using light loose rip–rap, 2–1/2" crushed ballast, and 1–1/4" crushed gravel to provide a secure base for subsequent soil lifts and plantings.

11. Using the trackhoe bucket, gently place the poplars and additional coniferous LWD into the water column, securing them along the bankline to the anchor rock with the chain attachments, and to each other, starting at the downstream end and proceeding upstream. Overlap cut log ends riverward of the next rootwad protruding downstream and secure overlapped logs to each other with additional one–inch diameter anchor chain. The LWD should overlap in a downstream direction as shown on the plan sheets. To the maximum extent, anchoring of the LWD should secure the logs as far below the OHWM as practical while minimizing the potential for individual logs to float up and become lodged on the bankline, during flood events. Precise placement of individual LWD pieces will be accomplished under the supervision of the project engineer and the Senior Ecologist.

12. Proceed as specified above in 15 foot increments upstream, relocating the floating turbidity curtain as needed for subsequent portions of the instream work, to the end of the project repair reach.

13. Remove turbidity curtain.

Levee Slope Reconstruction:

1. Following completion of all instream toe buttress construction and LWD placement, place a 3–inch lift of crushed quarry screenings the full length of the toe buttress along the top edge of the newly placed rock. Seal all underlying voids and to create a secure base for subsequent placement of soil lifts and planting layers. Make sure the top surface of the screenings is located at a minimum of six inches above the OHWM elevation.

2. Place an 8–inch layer of Groco–amended planting soil (≥ 20% Groco content) along the full length of the bench adjoining the riverbank within the project area, extending for a minimum of eight feet in width. Place a layer of live willow and dogwood cuttings onto the planting soil layer as shown on the cross section drawings. The cuttings will up to 10 feet in length in order to extend the width of the prepared soil lifts. Place additional potted native riparian shrub and tree species into the exposed edge of the soil lift as specified in the planting schedule. Butt ends of the cuttings can be up to four inches in diameter; exposed ends of the cuttings will extend no more than one foot riverward from the finished slope. Cover the layer of cuttings and potted plants with an additional 6 to 8 inches of planting soil and compact lightly with a single pass of the trackhoe or bulldozer tracks. Once installed in this manner, each layer of plantings will be embedded in a one foot minimum thickness of Groco–amended planting soil.

3. Import selected levee fill soils to the site and compact them in eight inch lifts to form fill layers between the layers of live cuttings. Each fill layer will be composed of three compacted soil lifts, extending the full length of the riverbank within the project area. Each finished fill layer will be wrapped with coir fabric for erosion protection.

4. Selected fill soils will be supplemented in lifts with crushed rock materials as noted above during periods of rainfall to provide for adequate compaction and to prevent pumping of mud in areas subject to equipment passage and truck traffic.

5. Alternate planting layers and coir wrapped fill and reconstruct lower embankment slopes to finished grade as shown on the cross section drawings and plan sheet.

6. The lower embankment slope lifts will be brought as close as possible to finished grade and mulched with straw on a daily basis as needed during any anticipated periods of rainy weather.

7. Hydroseed any remaining disturbed soil surfaces immediately following completion of all construction activities.

8. Stake slope areas subject to winter inundation with coir fabric over the completed hydroseed cover as needed to prevent winter erosion.

9. Plant middle and upper slope areas with additional potted native shrubs during the following plant dormancy season (October 1 through March 31) in accordance with planting plan and plant schedule shown on the project drawings.

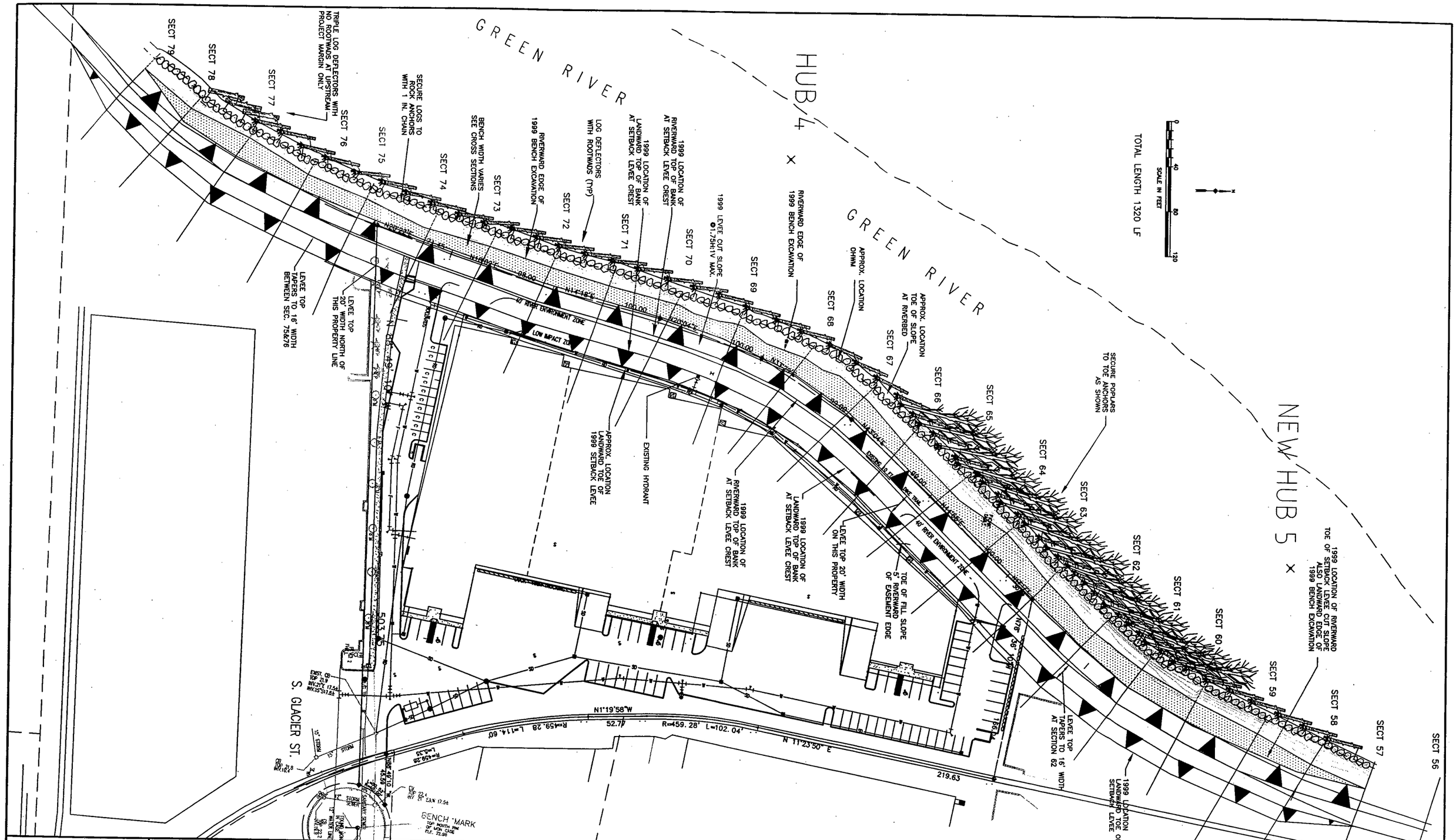
10. Water plants and grass seed as needed, twice a week minimum, until the onset of fall rains

11. Equipment Used: PC 225, 230 and 330 track hoes, 10 CY dump trucks, 18 CY belly dump trucks, pickup trucks, 1 ton flatbed trucks, 30' bed trash hauler, hydroseed truck, water truck, and D6 bulldozer.

Long Term ESC Monitoring:

All stabilized slope areas will be monitored for signs of erosion during wet winter months and immediately repaired. Repairs can include straw mulching, straw mulch packing of incipient rills, gravel patching of incised rills, additional placement of topsoil, additional hand– and/or hydroseeding, additional installation of willow & dogwood live cuttings and/or potted native riparian shrubs and trees, placement of washed rock filter berms, and localized placement of additional silt fencing. The goal is to maintain a vigorous establishment of dense, deeply rooted erosion control grasses and native riparian vegetation on all disturbed slope areas at all times.

SURVEYED: KC RIVERS	97–98				PROJECT MANAGER: ANDY LEVESQUE DATE: 1/01	PROJECT No. 089565		KING COUNTY DEPT. OF NATURAL RESOURCES PAM BISSONNETTE, DIRECTOR WATER AND LAND RESOURCES DIVISION DESIMONE LEVEE TOE REPAIR GREEN RIVER, RIVER MILE 15.45 R.B. COVER	SHEET 1 OF 5 SHEETS
BASE MAP PLOT:					PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 1/01				
DESIGN PLOT:					DESIGNED: ANDY LEVESQUE DATE: 1/01				
CHECKED:					DRAWN: KEN ZWEIG DATE: 1/01				RIVERS SECTION
FIELD BOOK:									
BY	DATE	REVISION	BY	DATE					



SURVEYED: KC RIVERS 97-98	TOR REPAIR REVISED	AL	12/00
BASE MAP PLOT:			
DESIGN PLOT:			
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FIELD BOOK:			
BY DATE	REVISION	BY	DATE

PROJECT MANAGER: ANDY LEVESQUE DATE: 1/01
PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 1/01
DESIGNED: ANDY LEVESQUE DATE: 1/01
DRAWN: KEN ZWEIG DATE: 1/01

PROJECT No. 089565

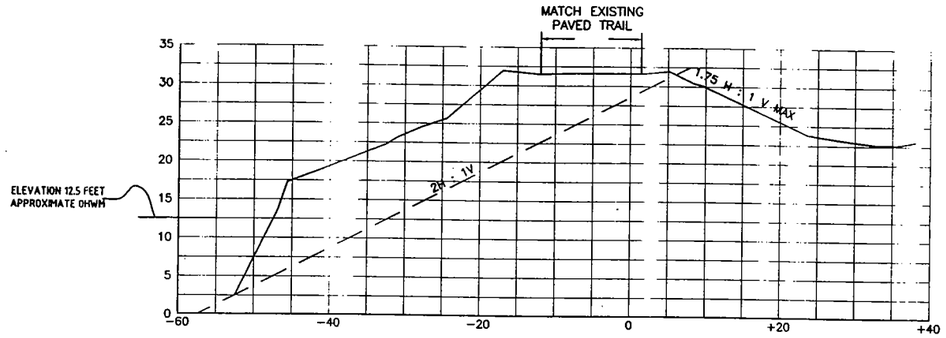
KING COUNTY DEPT. OF NATURAL RESOURCES
PAM BISSONNETTE, DIRECTOR
WATER AND LAND RESOURCES DIVISION

DESIMONE LEVEE TOE REPAIR

GREEN RIVER, RIVER MILE 15.45 R.B.
PROPOSED PLAN VIEW

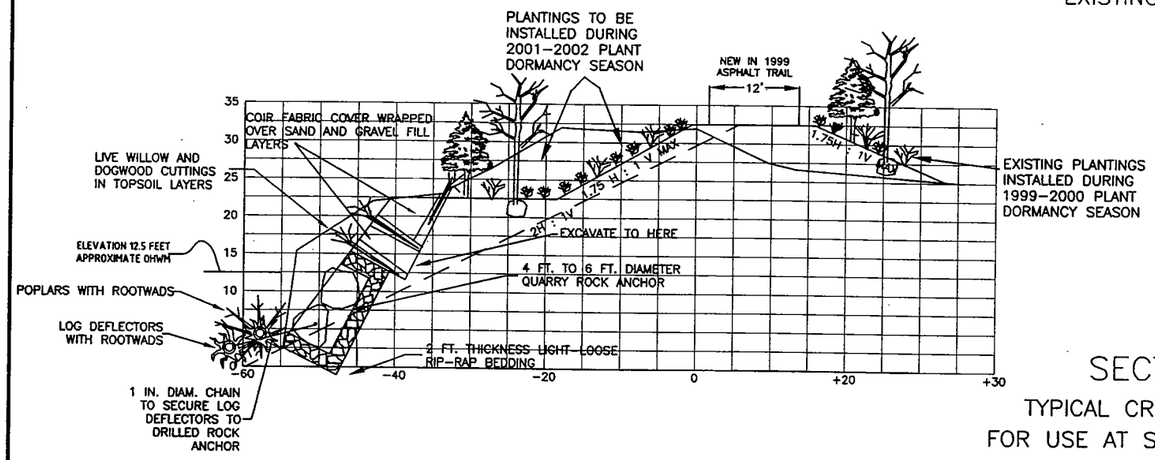
SHEET 2 OF 5 SHEETS

RIVERS SECTION



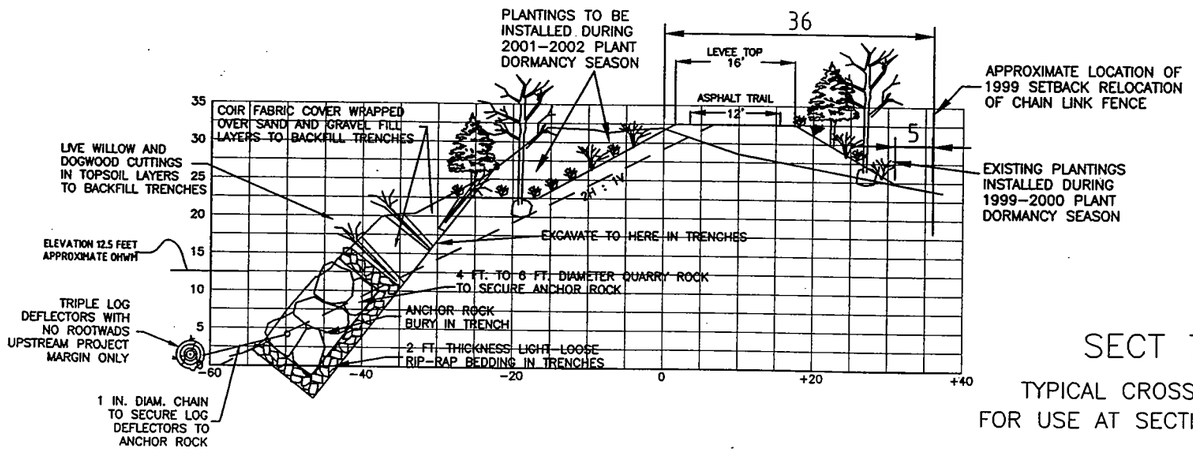
SECT 57

MATCH GRADES TO EXISTING SLOPE



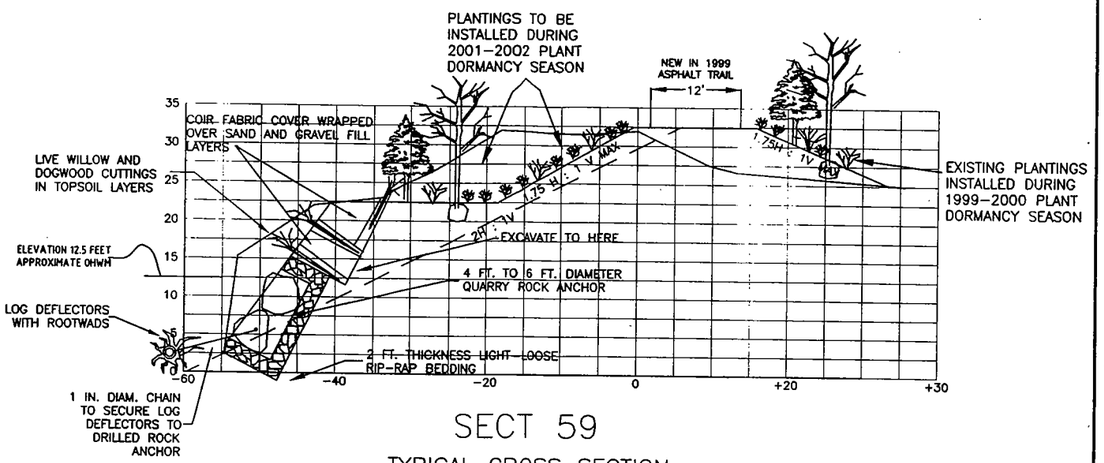
SECT 62

TYPICAL CROSS SECTION
FOR USE AT SECTIONS 60-66



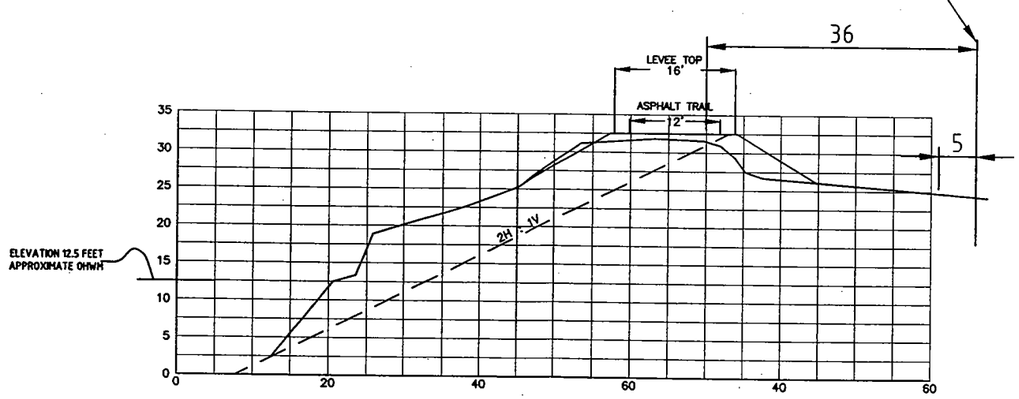
SECT 78

TYPICAL CROSS SECTION
FOR USE AT SECTION'S 77, 78



SECT 59

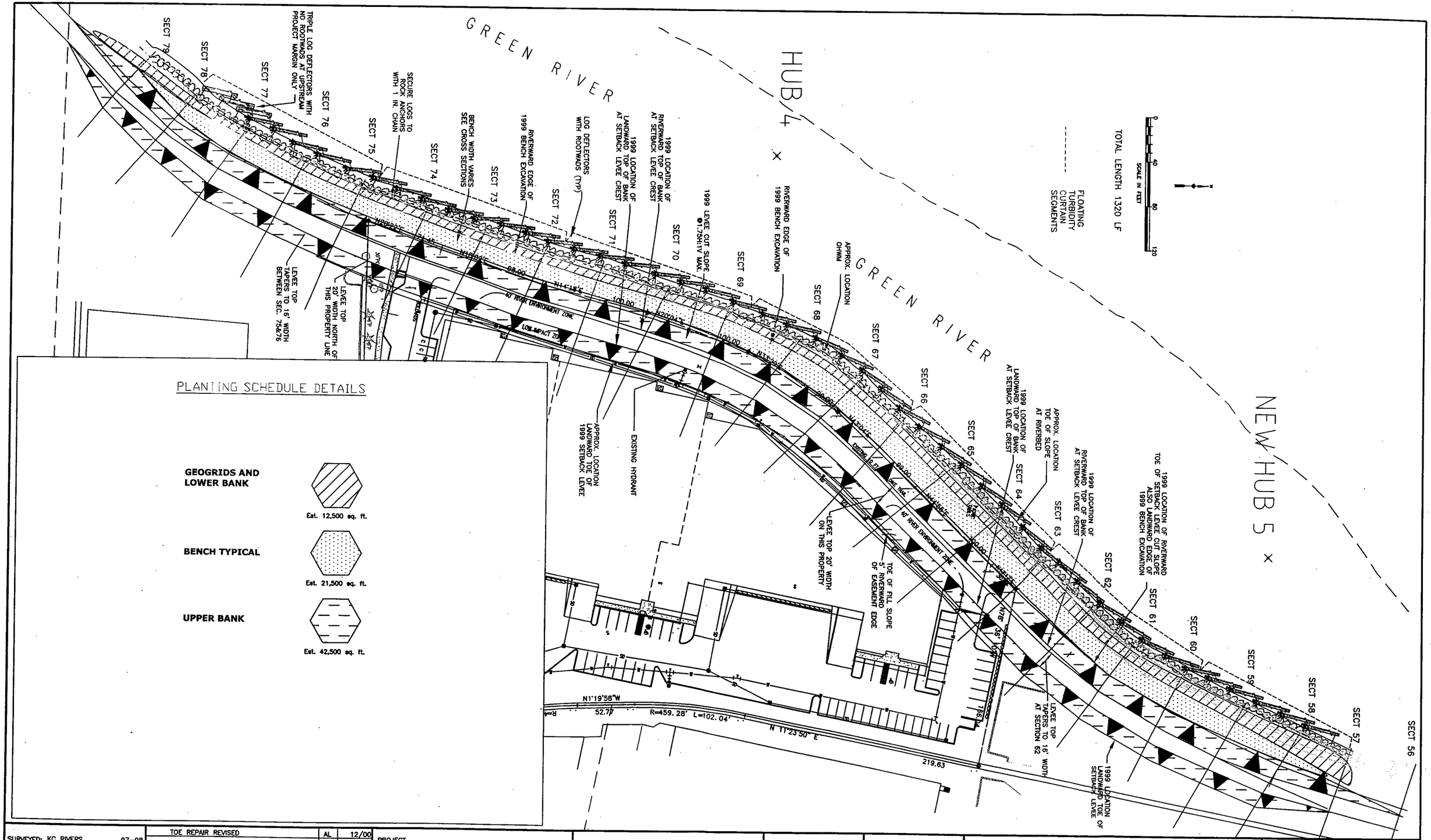
TYPICAL CROSS SECTION
FOR USE AT SECTIONS 58, 59 & 67-76



SECT 79

MATCH GRADES TO EXISTING SLOPE

SURVEYED: KC RIVERS	97-98				PROJECT MANAGER: ANDY LEVESQUE DATE: 1/01			KING COUNTY DEPT. OF NATURAL RESOURCES PAM BISSONNETTE, DIRECTOR WATER AND LAND RESOURCES DIVISION	SHEET 3 OF 5 SHEETS
BASE MAP PLOT:					PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 1/01			DESIMONE LEVEE TOE REPAIR GREEN RIVER, RIVER MILE 15.45 R.B. CROSS SECTIONS	
DESIGN PLOT:					DESIGNED: ANDY LEVESQUE DATE: 1/01				
CHECKED:					DRAWN: KEN ZWEIG DATE: 1/01				
FIELD BOOK:									
BY	DATE	REVISION	BY	DATE	PROJECT No. 089565				RIVERS SECTION



PLANTING SCHEDULE DETAILS

GEOGRIDS AND LOWER BANK

Est. 12,500 sq. ft.

BENCH TYPICAL

Est. 21,500 sq. ft.

UPPER BANK

Est. 42,500 sq. ft.

SURVEYED: KC RIVERS 97-98	TOE REPAIR REVISED	AL	12/00
BASE MAP PLOT:			
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FIELD BOOK:			
BY DATE	REVISION	BY	DATE

PROJECT MANAGER: ANDY LEVESQUE DATE: 1/01

PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 1/01

DESIGNED: ANDY LEVESQUE DATE: 1/01

DRAWN: KEN ZWEIG DATE: 1/01

PROJECT No. 089565

KING COUNTY DEPT. OF NATURAL RESOURCES
PAM BISSONNETTE, DIRECTOR
WATER AND LAND RESOURCES DIVISION

DESIMONE LEVEE TOE REPAIR

GREEN RIVER, RIVER MILE 15.45 R.B.
TEMPORARY EROSION & SEDIMENT CONTROL & PLANTING PLAN

SHEET 4 OF 5 SHEETS

RIVERS SECTION

PLANTING SCHEDULE

Total Plants By Species		Common Name	Species Name	Typical Pot Size	Approx. Spacing	Lower Bank	Bench	Upper Bank
			TREES					
50		Bigleaf Maple	Acer macrophyllum	1 gallon	10'+		55	0
185		Red Alder	Alnus rubra	1 gallon	6'+		185	0
185		Oregon Ash	Fraxinus latifolia	1 gallon	6'+	45	185	
185		Sitka Spruce	Picea sitchensis	1 gallon	10'+		185	
235		Black Cottonwood	Populus trichocarpa	1 gallon	6'+	45	320	
185		Western Crabapple	Pyrus fusca	1 gallon	6'+	45	185	
185		Western Red Cedar	Thuja plicata	1 gallon	6'+		185	0
Total Trees	**1210**				**TOTAL**	**135**	**1300**	**0**
			SHRUBS					
548		Serviceberry	Amelanchier alnifolia	1 gallon	4'+			548
415		Red-osier Dogwood	Cornus stolonifera	1 gallon	4'+	275	140	
548		Western Hazelnut	Corylus cornutus	1 gallon	4'+			548
688		Black Hawthorn	Cratageus douglasii	1 gallon	4'+		140	548
548		Oceanspray	Holodiscus discolor	1 gallon	4"+			548
415		Black Twinberry	Lonicera involucrata	1 gallon	4"+	275	140	
274		Indian Plum	Oemleria cerasiformis	1 gallon	4'+			274
415		Pacific Ninebark	Physocarpus capitatus	1 gallon	4'+	275	140	
274		Red Flowering Current	Ribes sanguineum	1 gallon	3'+			274
427		Nootka Rose	Rosa nutkana	1 gallon	3'+		140	274
427		Baldhip Rose	Rosa pisocarpa	1 gallon	3'+		140	274
274		Thimbleberry	Rubus parviflorus	1 gallon	4'+			274
140		Salmonberry	Rubus spectabilis	1 gallon	4'+		140	
3425		Red Elderberry	Sambucus racemosa	1 gallon	2'+		1300	2125
688		Snowberry	Symphoricarpos alba	1 gallon	4'+		140	548
Total Shrubs	**9506**				**TOTAL**	**825**	**2420**	**6235**

SURVEYED: KC RIVERS 97–98	TOE REPAIR REVISED	AL	12/00	PROJECT MANAGER: ANDY LEVESQUE DATE: 1/01	PROJECT No. 089565
BASE MAP PLOT:				PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 1/01	
DESIGN PLOT:				DESIGNED: ANDY LEVESQUE DATE: 1/01	
CHECKED:				DRAWN: KEN ZWEIG DATE: 1/01	
FIELD BOOK:					
BY DATE	REVISION	BY	DATE		

KING COUNTY DEPT. OF NATURAL RESOURCES
PAM BISSONNETTE, DIRECTOR
WATER AND LAND RESOURCES DIVISION

DESIMONE LEVEE TOE REPAIR

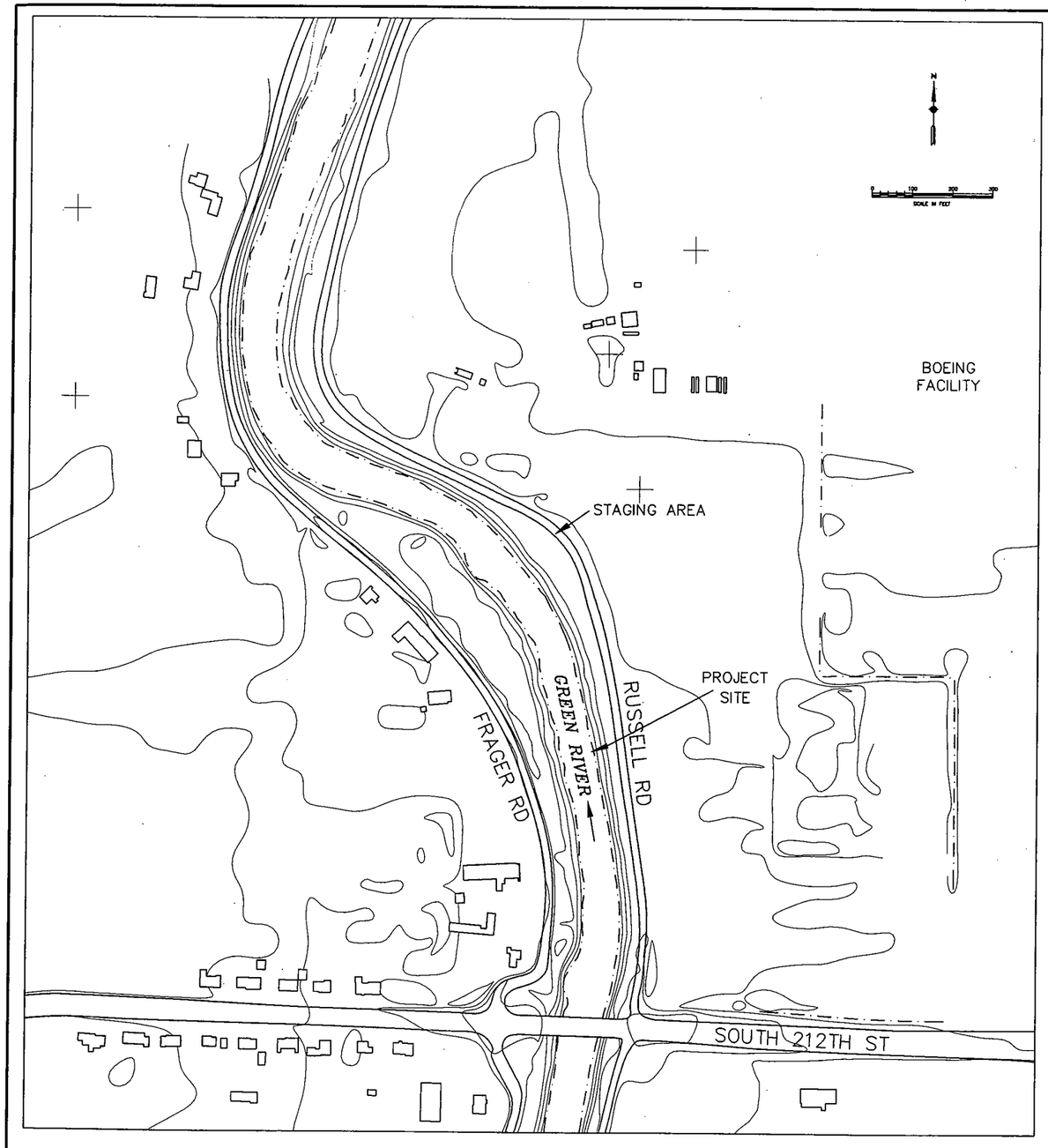
GREEN RIVER, RIVER MILE 15.45 R.B.
PLANTING PLAN

SHEET 5 OF 5 SHEETS

RIVERS SECTION

BOEING LEVEE REPAIR

GREEN RIVER FLOOD CONTROL ZONE DISTRICT

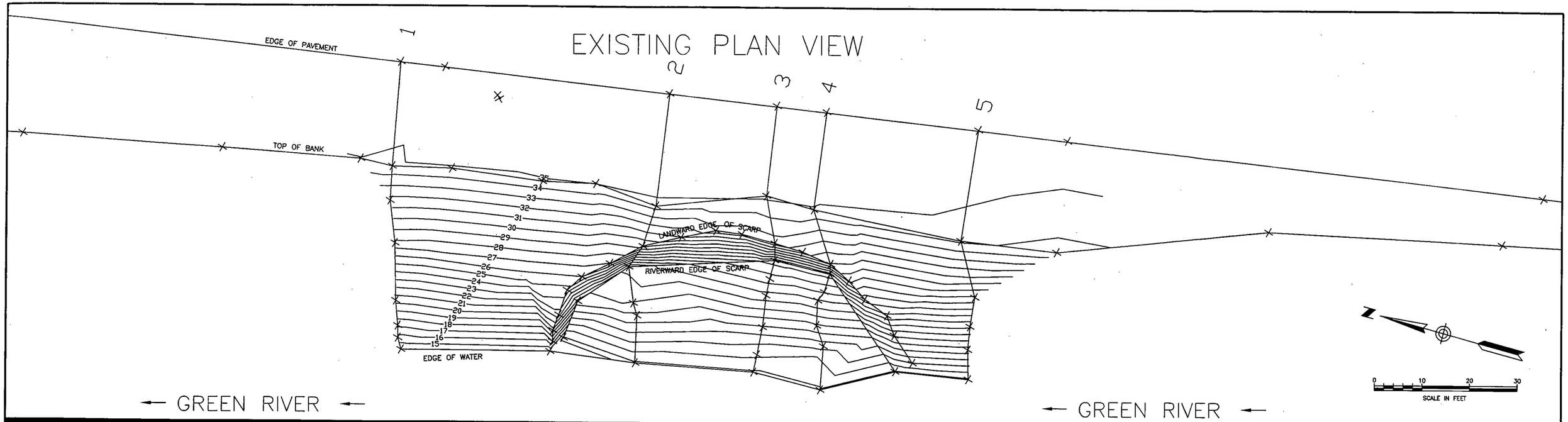


SECTION: 11
TOWNSHIP: 22N
RANGE: 04E

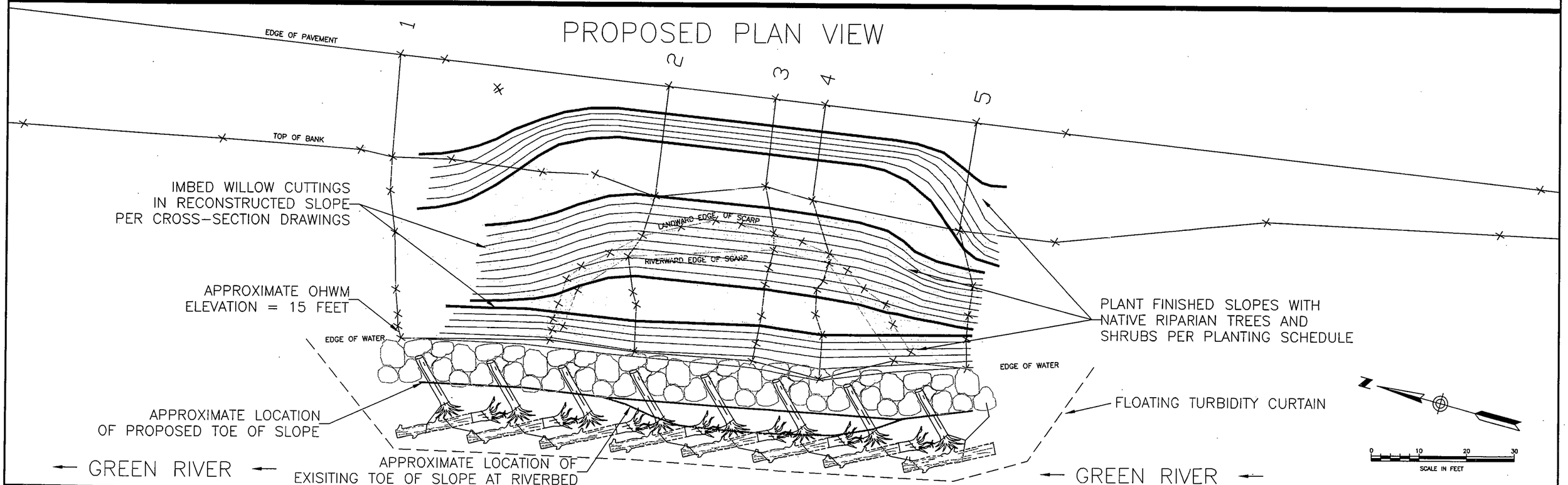
PROJECT LOCATION WITHIN CITY OF KENT, WASHINGTON

SURVEYED: KC	4-23-99				PROJECT MANAGER: ANDY LEVESQUE DATE: 1/01		KING COUNTY DEPT. OF NATURAL RESOURCES PAM BISSONNETTE, DIRECTOR WATER AND LAND RESOURCES DIVISION	SHEET 1 OF 5 SHEETS
BASE MAP PLOT:					PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 1/01		BOEING LEVEE REPAIR GREEN RIVER, RM 17.63, RB TITLE SHEET	RIVERS SECTION
DESIGN PLOT:					DESIGNED: ANDY LEVESQUE DATE: 1/01			
CHECKED:					DRAWN: KEN ZWEIG DATE: 1/01			
FIELD BOOK:								
BY	DATE	REVISION	BY	DATE				

EXISTING PLAN VIEW



PROPOSED PLAN VIEW



SURVEYED: KC	4-23-99				PROJECT MANAGER: ANDY LEVESQUE	DATE: 1/01	
BASE MAP PLOT:					PROJECT ECOLOGIST: RUTH SCHAEFER	DATE: 1/01	
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BY	DATE	REVISION	BY	DATE			

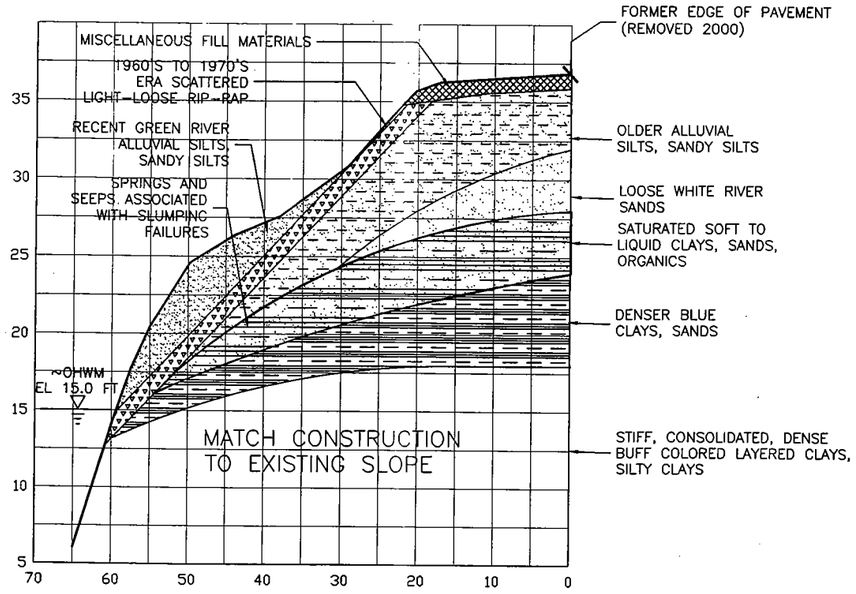
KING COUNTY DEPT. OF NATURAL RESOURCES
PAM BISSONNETTE, DIRECTOR
WATER AND LAND RESOURCES DIVISION

BOEING LEVEE REPAIR

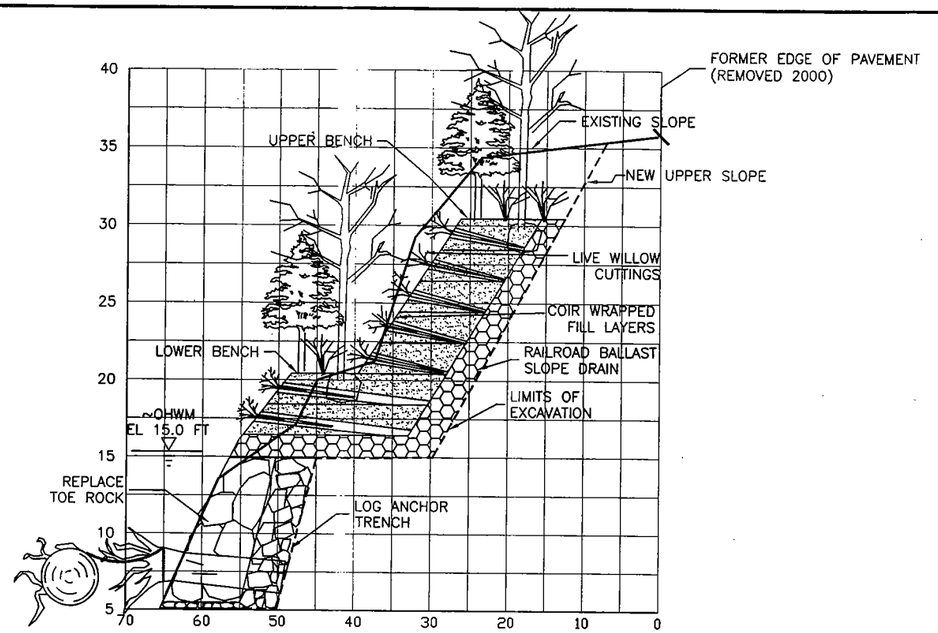
GREEN RIVER, RM 17.63, RB
EXISTING & PROPOSED PLAN VIEW

SHEET 2 OF 5 SHEETS

RIVERS SECTION

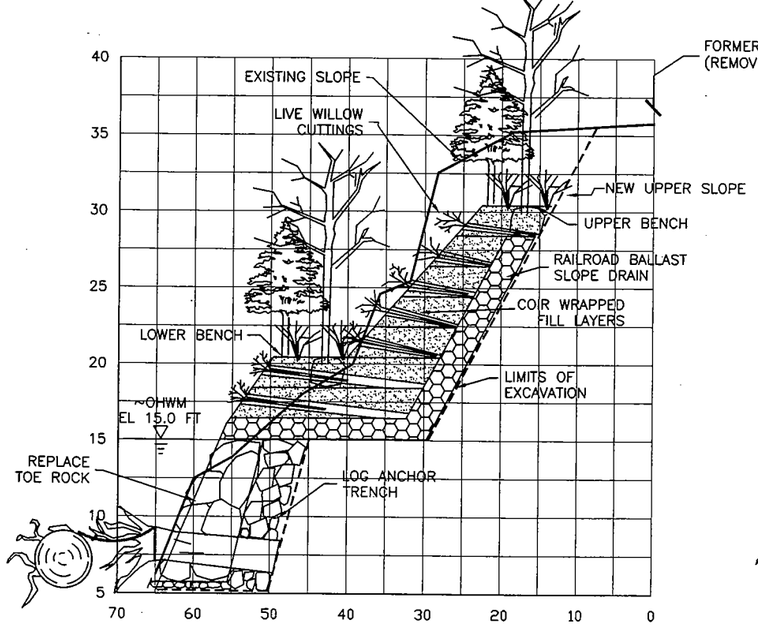


SECTION 1

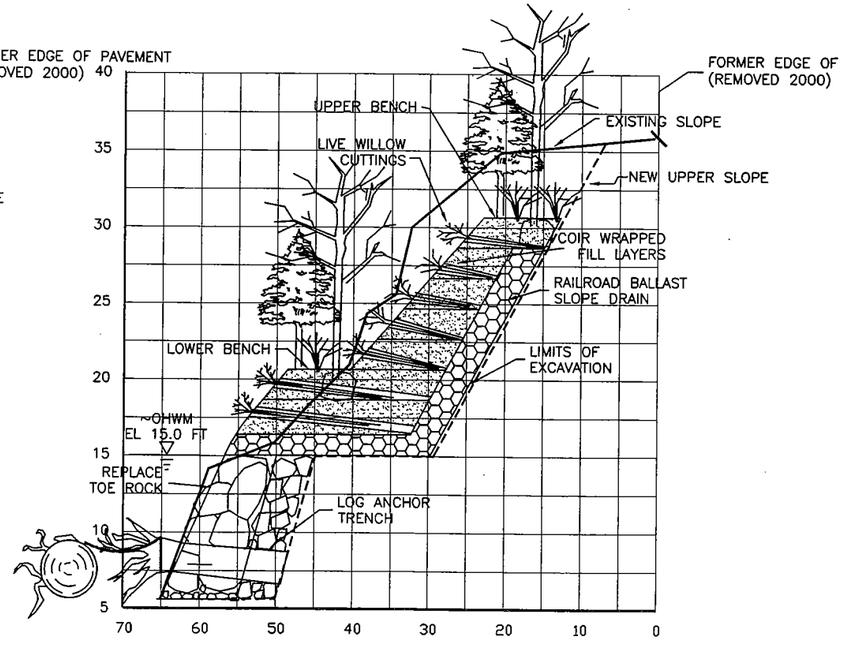


SECTION 2

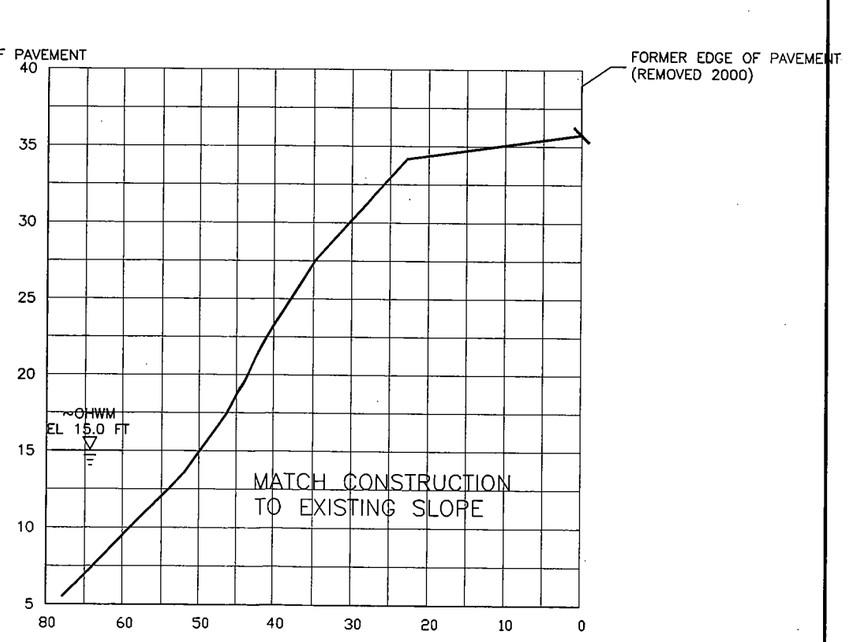
(GENERALIZED GEOLOGIC STRATA SHOWN)



SECTION 3



SECTION 4



SECTION 5

SURVEYED: KC 4-23-99				PROJECT MANAGER: ANDY LEVESQUE DATE: 1/01			KING COUNTY DEPT. OF NATURAL RESOURCES PAM BISSONNETTE, DIRECTOR WATER AND LAND RESOURCES DIVISION BOEING LEVEE REPAIR GREEN RIVER, RM 17.63, RB CROSS SECTIONS	SHEET 3 OF 5 SHEETS
BASE MAP PLOT:				PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 1/01				
DESIGN PLOT:				DESIGNED: ANDY LEVESQUE DATE: 1/01				
CHECKED:				DRAWN: KEN ZWEIG DATE: 1/01				
FIELD BOOK:								
BY DATE	REVISION	BY	DATE				RIVERS SECTION	

Temporary Erosion and Sediment Control (TESC):

The following will be brought to the site and staged on a daily basis as needed:
Straw bales for slope mulching
Silt fencing for perimeter siltation control
Crushed or washed rock for control of soil pumping on exposed soils in heavy traffic areas
5/8 inch minus crushed rock for staging areas and road shoulders
Pea gravel for filter berms and silt fence installations
Hand brooms, street sweepers, and wash trucks for control of sediments on paved traffic surfaces

An undisturbed band of existing vegetation will be left intact along the waterline until excavation of failed or damaged toe buttress areas for installation of crushed rock bedding, toe rock, LWD anchor rocks, and LWD.

A turbidity curtain will be installed at the site during in-water construction

All in-water construction will occur between June 15 and August 15, 2001, to avoid extended periods of rainy weather and high river discharge, and to coincide with the period of minimum habitat utilization by juvenile and adult salmonids

All paved traffic areas will be kept free from sediment accumulations by daily sweeping and washing.

Turbidity will be monitored at the construction site, at flagged sampling stations 50 feet upstream from the excavation area and 250 feet downstream from the excavation area to facilitate compliance with limits on turbidity set forth in Washington Department of Ecology Order No. DE 97WQ-007 (February 24, 1997), and at a flagged sampling station located one mile downstream from the site.

Construction Sequence; Toe and Bank Repair:

1. Stake limits of construction area at site.

2. Trench silt fence into riverbank slope, at lower limits of construction bench area, leaving an intact band of undisturbed vegetation downslope from the silt fence location, extending to the OHWM.

3. Place pea gravel berm to anchor silt fence into trench.

4. Excavate upper embankment slopes to create and shape ramps to access construction bench excavation area, from both upstream and downstream of bench area.

5. Operating from the upper bank and from the ramps as needed, excavate the construction bench, landward of the silt fence.

6. As excavation encounters saturated clay materials at depth, overexcavate these materials in ten to 15 foot long increments, including overexcavation of underlying soft clay and peat soils as needed to secure equipment access along the construction bench. Immediately backfill excavated areas with firm bearing crushed railroad ballast and quarry spall bedding materials to form a firm base for the trackhoe, trucks, and other construction equipment operating on the bench.

7. Place a minimum thickness of three feet of crushed railroad ballast to form a slope drain to capture and control any seepage present in the clay soil materials exposed in the excavated embankment cutslope or at depth, as shown on the cross section drawings in the project plans. A minimum thickness of three feet of crushed railroad ballast must be maintained at all times as a surficial treatment of the exposed construction bench, landward of and at a minimum elevation of six inches lower than the silt fence installation.

8. Starting at the downstream project limits, install the floating turbidity curtain in 175-foot-long increments to isolate the instream work area(s) from the flowing stream.

9. Starting at downstream project limits, construct toe repairs in fifteen foot long (maximum) increments, as follows:

10. Starting at the downstream end of the project, clear and grub existing blackberries and reed canarygrass from the lower bank slope, above the OHWM, in 15 foot increments. Export these plant and soil materials to an approved disposal location (Pacific Topsoil site in Kent or King County Roads Division soil recycling center in Renton).

11. Excavate existing failed levee rip-rap and unsuitable subgrade materials from the lower embankment slopes, above the water surface elevation, in the same 15 foot increments. Export these materials to an approved disposal location (Pacific Topsoil site in Kent or King County Roads Division soil recycling center in Renton).

12. Excavate failed or damaged toe buttress areas and unsuitable subgrade materials from below the water surface elevation for placement of new crushed rock bedding, toe rock, and LWD anchor rocks, in the same 15 foot increment. Working from the embankment side toward the water's edge, leave an intact earthen "plug" at the riverward edge of the toe rock and LWD trench excavation area until the moment of actual LWD, toe buttress bedding and rock placement in order to minimize turbidity.

13. Excavate and remove the earthen "plug" from along the water's edge, completing the excavation to depth as rapidly as possible. Immediately place 2-1/4" crushed railroad ballast and quarry spalls to stabilize the exposed riverbed and embankment soils, and to provide suitable bedding conditions for placement of LWD and toe rock. Complete this work within the same 15 foot increments.

14. Place LWD within the prepared toe trench bedding area at a 15 foot spacing, as shown on the plan drawings. Place additional toe buttress rocks in place to firmly secure the LWD in place, and to secure the entire toe buttress against undercutting erosion,

15. Working within the same 15 foot increments as above, level the top edge of the rock toe buttress at a finished elevation approximately one foot above the OHWM, using light loose rip-rap, 2-1/2" crushed ballast, and 1-1/4" crushed gravel to provide a secure base for subsequent soil lifts and plantings.

16. Using the trackhoe bucket, gently place the additional coniferous LWD into the water column, securing them along the bankline to the imbedded LWD with the chain attachments, and to each other, starting at the downstream end and proceeding upstream. Overlap cut log ends riverward of the next rootwad protruding downstream and secure overlapped logs to each other with additional one-inch diameter anchor chain. The LWD should overlap in a downstream direction as shown on the plan sheets. To the maximum extent, anchoring of the LWD should seek to secure the logs below the OHWM as fully as possible, while minimizing the potential for individual logs to float up onto the bankline, during flood events. Precise placement of individual LWD pieces will be accomplished under the supervision of the project engineer and the Senior Ecologist.

17. Proceed as specified above in 15 foot increments upstream, relocating the floating turbidity curtain as needed for subsequent portions of the instream work, to the end of the project repair reach.

18. Remove turbidity curtain

Levee slope reconstruction:

1. Following completion of all instream toe buttress construction and LWD placement, place a 3-inch lift of crushed quarry screenings the full length of the toe buttress along the top edge of the newly placed rock. Seal all underlying voids and to create a secure base for subsequent placement of soil lifts and planting layers. Make sure the top surface of the screenings is located at a minimum of six inches above the OHWM elevation.

2. Place an 8-inch layer of Groco-amended planting soil (≥ 20% Groco) along the full length of the bench adjoining the riverbank within the project area, extending for a minimum of eight feet in width. Place a layer of live willow and dogwood cuttings onto the planting soil layer as shown on the cross section drawings. The cuttings will up to 10 feet in length in order to extend the width of the prepared soil lifts. Place additional potted native riparian shrub and tree species into the exposed edge of the soil lift as specified in the planting schedule. Butt ends of the cuttings can be up to four inches in diameter; exposed ends of the cuttings will extend no more than one foot riverward from the finished slope. Cover the layer of cuttings with an additional 6 to 8 inches of planting soil and compact lightly with a single pass of the trackhoe. Once installed in this manner, each layer of cuttings will be embedded in a one foot minimum thickness of Groco-amended planting soil.

3. Import selected levee fill soils to the site and compact them in eight inch lifts to form fill layers between the layers of live cuttings. Each fill layer will be composed of three compacted soil lifts, extending the full length of the riverbank within the project area. Each finished fill layer will be wrapped with coir fabric for erosion protection.

4. Selected fill soils will be supplemented in lifts with crushed rock materials as noted above during periods of rainfall to provide for adequate compaction and to prevent pumping of mud in areas subject to equipment passage and truck traffic.

5. Alternate willow layers and coir wrapped fill and reconstruct lower and upper embankment slopes to finished grade as shown on the cross section drawings and plan sheet.

6. The embankment slope lifts will be brought as close as possible to finished grade and mulched with straw on a daily basis as needed during any anticipated periods of rainy weather.

7. Hydroseed any remaining disturbed soil surfaces following completion of all construction activities.

8. Stake slope areas subject to winter inundation with coir fabric over the completed hydroseed cover as needed to prevent winter erosion.

9. Plant middle and upper slope areas with potted upland native shrubs during the following plant dormancy season (October 1 through March 31) in accordance with planting plan and plant schedule shown on the project drawings.

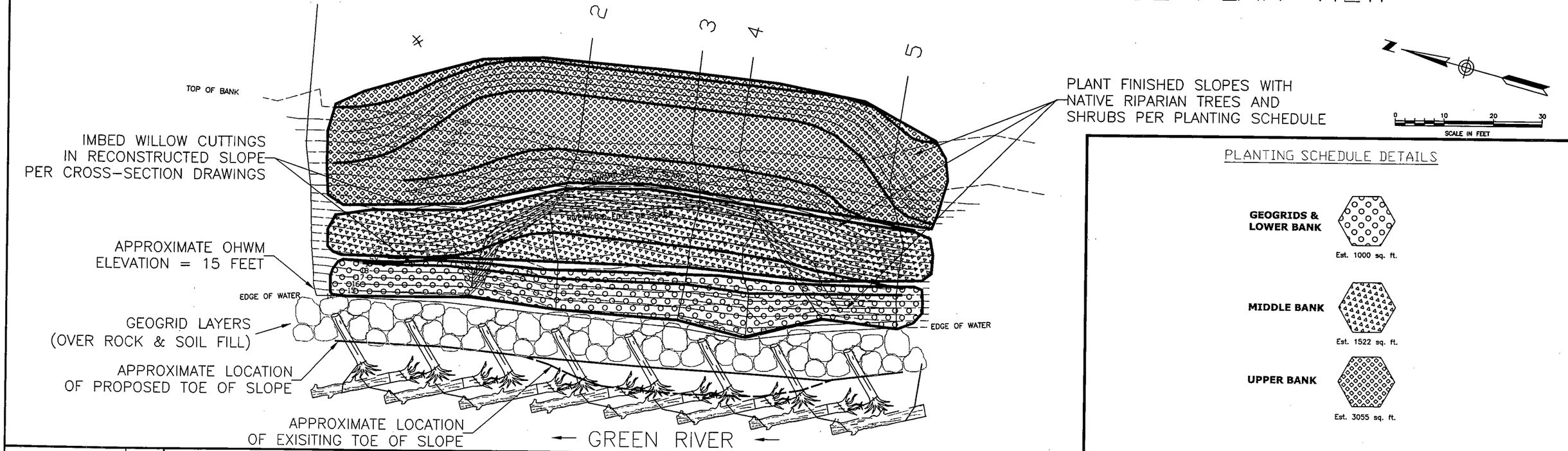
10. Water plants and grass seed as needed, twice a week minimum, until the onset of fall rains

Equipment Used: PC 225, 230 and 330 track hoes, 10 CY dump trucks, 18 CY belly dump trucks, pickup trucks, 1 ton flatbed trucks, 30' bed trash hauler, hydroseed truck, water truck, and D6 bulldozer.

Long Term ESC Monitoring:

All stabilized slope areas will be monitored for signs of erosion during wet winter months and immediately repaired. Repairs can include straw mulching, straw mulch packing of incipient rills, gravel patching of incised rills, additional placement of topsoil, additional hand- and/or hydroseeding, placement of washed rock filter berms, and localized placement of additional silt fencing. The goal is to maintain a vigorous establishment of dense, deeply rooted erosion control grasses and native riparian vegetation on all disturbed slope areas at all times.

TEMPORARY EROSION AND SEDIMENT CONTROL PLAN VIEW



PLANTING SCHEDULE DETAILS

GEOGRIDS & LOWER BANK
Est. 1000 sq. ft.

MIDDLE BANK
Est. 1522 sq. ft.

UPPER BANK
Est. 3055 sq. ft.

SURVEYED: KC	4-23-99				PROJECT MANAGER: ANDY LEVESQUE	DATE: 1/01	KING COUNTY DEPT. OF NATURAL RESOURCES PAM BISSONNETTE, DIRECTOR WATER AND LAND RESOURCES DIVISION
BASE MAP PLOT:					PROJECT ECOLOGIST: RUTH SCHAEFER	DATE: 1/01	BOEING LEVEE REPAIR GREEN RIVER, RM 17.63, RB TEMPORARY EROSION AND SEDIMENT CONTROL PLAN
DESIGN PLOT:					DESIGNED: ANDY LEVESQUE	DATE: 1/01	SHEET 4 OF 5 SHEETS
CHECKED:					DRAWN: KEN ZWEIG	DATE: 1/01	RIVERS SECTION
FIELD BOOK:							
BY	DATE	REVISION	BY	DATE			

PLANTING SCHEDULE

Total Plants By Species		Common Name	Species Name	Typical Pot Size	Approx. Spacing	Lower Bank	Middle Bank	Upper Bank
			TREES					
		Bigleaf Maple	Acer macrophyllum	1 gallon	10'+		2	5
		Red Alder	Alnus rubra	1 gallon	6'+		4	5
		Oregon Ash	Fraxinus latifolia	1 gallon	6'+	6	4	
		Sitka Spruce	Picea sitchensis	1 gallon	10'+		4	
		Black Cottonwood	Populus trichocarpa	1 gallon	6'+	8	4	
		Bitter Cherry	Prunus emarginata	1 gallon	6'+			5
		Douglas Fir	Pseudotsuga menziesii	1 gallon	10'+			5
		Western Crabapple	Pyrus fusca	1 gallon	6'+	6	4	
		Cascara	Rhamnus purshiana	1 gallon	6'+			5
		Western Red Cedar	Thuja plicata	1 gallon	6'+		4	5
		Western Hemlock	Tsuga heterophylla	1 gallon	6'+			5
Total Trees	**70**				**TOTAL**	**20**	**26**	**34**
			SHRUBS					
		Serviceberry	Amelanchier alnifolia	1 gallon	4'+			10
		Red-osier Dogwood	Cornus stolonifera	1 gallon	4'+	20	5	
		Western Hazelnut	Corylus cornutus	1 gallon	4'+			10
		Black Hawthorn	Crataegus douglasii	1 gallon	4'+		5	10
		Oceanspray	Holodiscus discolor	1 gallon	4"+			10
		Black Twinberry	Lonicera involucrata	1 gallon	4"+	20	5	
		Indian Plum	Oemleria cerasiformis	1 gallon	4'+			10
		Pacific Ninebark	Physocarpus capitatus	1 gallon	4'+	20	5	
		Red Flowering Current	Ribes sanguineum	1 gallon	3'+			10
		Nootka Rose	Rosa nutkana	1 gallon	3'+		5	10
		Baldhip Rose	Rosa pisocarpa	1 gallon	3'+		5	10
		Thimbleberry	Rubus parviflorus	1 gallon	4'+			10
		Salmonberry	Rubus spectabilis	1 gallon	4'+		10	
		Red Elderberry	Sambucus racemosa	1 gallon	2'+		49	79
		Snowberry	Symphoricarpos alba	1 gallon	4'+		5	20
Total Shrubs as Needed	**315**				**TOTAL**	**60**	**93**	**187**

SURVEYED: KC	4-23-99				
BASE MAP PLOT:					
DESIGN PLOT:					
CHECKED:					
FIELD BOOK:					
BY	DATE	REVISION	BY	DATE	

PROJECT MANAGER: ANDY LEVESQUE DATE: 1/01

PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 1/01

DESIGNED: ANDY LEVESQUE DATE: 1/01

DRAWN: KEN ZWEIG DATE: 1/01

KING COUNTY DEPT. OF NATURAL RESOURCES
PAM BISSONNETTE, DIRECTOR
WATER AND LAND RESOURCES DIVISION

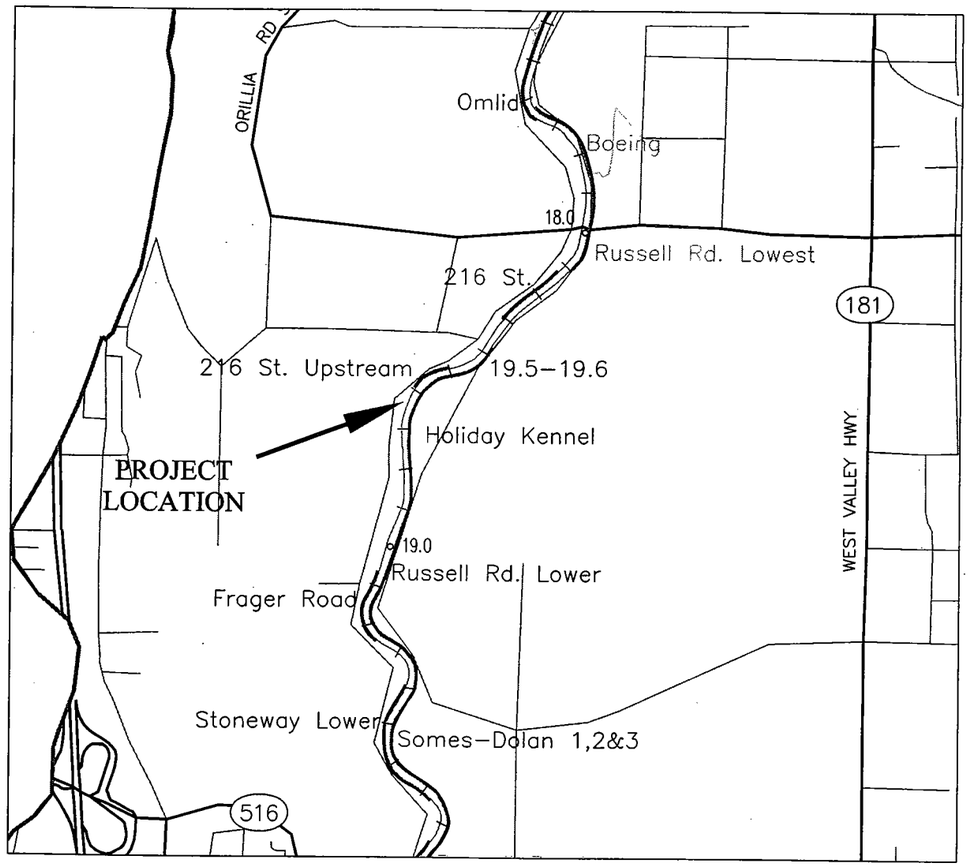
BOEING LEVEE REPAIR

GREEN RIVER, RM 17.63, RB
PLANTING PLAN

SHEET 5 OF 5 SHEETS

RIVERS SECTION

FRAGER ROAD REVETMENT REPAIR



Frager Road Revetment Slump Repair (proposed for construction in 2001)

Temporary Erosion and Sediment Control (TESC):

*The following will be brought to the site and staged on a daily basis as needed:
*Straw bales for slope mulching
*Silt fencing for perimeter siltation control
*Crushed or washed rock for control of soil pumping on exposed soils in heavy traffic areas
*5/8 inch minus crushed rock for staging areas and road shoulders
*Pea gravel for filter berms and silt fence installations
*Hand brooms, street sweepers, and wash trucks for control of sediments on paved traffic surfaces

*An undisturbed band of existing vegetation will be left intact along the waterline until excavation of failed or damaged toe buttress areas for installation of crushed rock bedding, toe rock, LWD anchor rocks, habitat niche culverts, and LWD.

*A turbidity curtain will be installed at the site during in-water construction

*All in-water construction will occur between June 15 and August 15, 2001, to avoid extended periods of rainy weather and high river discharge, and to coincide with the period of minimum habitat utilization by juvenile and adult salmonids.

*All paved traffic areas will be kept free from sediment accumulations by daily sweeping and washing.

*Turbidity will be monitored at the construction site, at flagged sampling stations 50 feet upstream from the excavation area and 250 feet downstream from the excavation area to facilitate compliance with limits on turbidity set forth in Washington Department of Ecology Order No. DE 97WQ-007 (February 24, 1997), and at a flagged sampling station located one mile downstream from the site.

Construction Sequence; Toe and Bank Repair:

1. Stake limits of construction area at site.

2. Trench silt fence into riverbank slope, at lower limits of construction bench area, leaving an intact band of undisturbed vegetation downslope from the silt fence location, extending to the OHWM.

3. Place pea gravel berm to anchor silt fence into trench.

4. Excavate upper embankment slopes to create and shape ramps to access construction bench excavation area, from both upstream and downstream of bench area.

5. Operating from the upper bank and from the ramps as needed, excavate the construction bench, landward of the silt fence.

6. Starting at the downstream end of the project, install the floating turbidity curtain in 175-foot-long increments to isolate the instream work area(s) from the flowing stream.

7. Starting at the downstream project, construct toe repairs in fifteen foot long (maximum) increments, as follows:

8. Starting at the downstream end of the project, clear and grub existing blackberries and reed canarygrass from the lower bank slope, above the OHWM, in 15 foot increments. Export these plant and soil materials to an approved disposal location (Pacific Topsoil site in Kent or King County Roads Division soil recycling center in Renton).

9. Excavate existing failed levee rip-rap and unsuitable subgrade materials from the lower embankment slopes, above the water surface elevation, in the same 15 foot increment. Export these materials to an approved disposal location (Pacific Topsoil site in Kent or King County Roads Division soil recycling center in Renton).

10. Excavate failed or damaged toe buttress areas and unsuitable subgrade materials from below the water surface elevation for placement of new crushed rock bedding, toe rock, habitat niche culverts, and LWD anchor rocks, in the same 15 foot increments. Working from the embankment side toward the water's edge, leave an intact earthen "plug" at the riverward edge of the toe rock and LWD trench excavation area until the moment of actual LWD, toe buttress bedding, habitat niche culvert, and toe rock placement in order to minimize turbidity.

11. Excavate and remove the earthen "plug" from along the water's edge, completing the excavation to depth as rapidly as possible. Immediately place 2-1/4" crushed railroad ballast and quarry spalls to stabilize the exposed riverbed and embankment soils, and to provide suitable bedding conditions for placement of LWD, habitat niche culverts, and toe rock. Complete this work within the same 15 foot increments.

12. Place habitat niche culverts and LWD within the prepared toe trench bedding area at a 12 foot spacing, as shown on the plan drawings. Place additional toe buttress rocks to firmly secure the LWD and culverts in place, and to secure the entire toe buttress against undercutting erosion, working within the same 15 foot increments as above. Level the top edge of the rock toe buttress at a finished elevation approximately one foot above the OHWM, using light loose rip-rap, 2-1/2" crushed ballast, and 1-1/4" crushed gravel to provide a secure base for subsequent soil lifts and plantings.

13. Using the trackhoe bucket, gently place the additional coniferous LWDs into the water column, securing them along the bankline to the imbedded LWDs with the chain attachments, and to each other, starting at the downstream end and proceeding upstream. Overlap cut log ends riverward of the next rootwad protruding downstream and secure overlapped logs to each other with additional one-inch diameter anchor chain. The LWD should overlap in a downstream direction as shown on the plan sheets. To the maximum extent, anchoring of the LWD should seek to secure the logs below the OHWM as fully as possible, while minimizing the potential for individual logs to float up, onto the bankline, during flood events. Precise placement of individual LWD pieces will be accomplished under the supervision of the project engineer and the Senior Ecologist.

14. Proceed as specified above in 15 foot increments upstream, relocating the floating turbidity curtain as needed for subsequent portions of the instream work, to the end of the project repair reach.

15. Remove turbidity curtain

Levee slope reconstruction:

1. Following completion of all instream toe buttress construction and LWD placement, place a 3-inch lift of crushed quarry screenings the full length of the toe buttress along the top edge of the newly placed rock, logs, and culverts. Seal all underlying voids and to create a secure base for subsequent placement of soil lifts and planting layers. Make sure the top surface of the screenings is located at a minimum of one foot above the OHWM elevation, in order to provide adequate cover over the top of the culverts.

2. Place an 8-inch layer of Groco-amended planting soil (≥ 20% Groco) along the full length of the bench adjoining the riverbank within the project area, extending for a minimum of eight feet in width. Place a layer of live willow and dogwood cuttings onto the planting soil layer as shown on the cross section drawings. The cuttings will up to 10 feet in length in order to extend the width of the prepared soil lifts. Place additional native riparian shrub and tree species into the exposed edge of the soil lift as specified in the planting schedule. Butt ends of the cuttings can be up to four inches in diameter; exposed ends of the cuttings will extend no more than one foot riverward from the finished slope. Cover the layer of cuttings with an additional 6 to 8 inches of planting soil and compact lightly with a single pass of the trackhoe. Once installed in this manner, each layer of cuttings will be embedded in a one foot minimum thickness of Groco-amended planting soil.

3. Import selected levee fill soils to the site and compact them in eight inch lifts to form fill layers between the layers of live cuttings. Each fill layer will be composed of three compacted soil lifts, extending the full length of the riverbank within the project area. Each finished fill layer will be wrapped with coir fabric for erosion protection.

4. Selected fill soils will be supplemented in lifts with crushed rock materials as noted above during periods of rainfall to provide for adequate compaction and to prevent pumping of mud in areas subject to equipment passage and truck traffic.

5. Alternate willow layers and coir wrapped fill and reconstruct the embankment slopes to finished grade as shown on the cross section drawings and plan sheet.

6. The embankment slope lifts will be brought as close as possible to finished grade and mulched with straw on a daily basis as needed during any anticipated periods of rainy weather.

7. Hydroseed any remaining disturbed soil surfaces following completion of all construction activities.

8. Stake slope areas subject to winter inundation with coir fabric over the completed hydroseed cover as needed to prevent winter erosion.

9. Plant middle and upper slope areas with potted upland native shrubs and trees during the following plant dormancy season (October 1 through March 31) in accordance with planting plan and plant schedule shown on the project drawings.

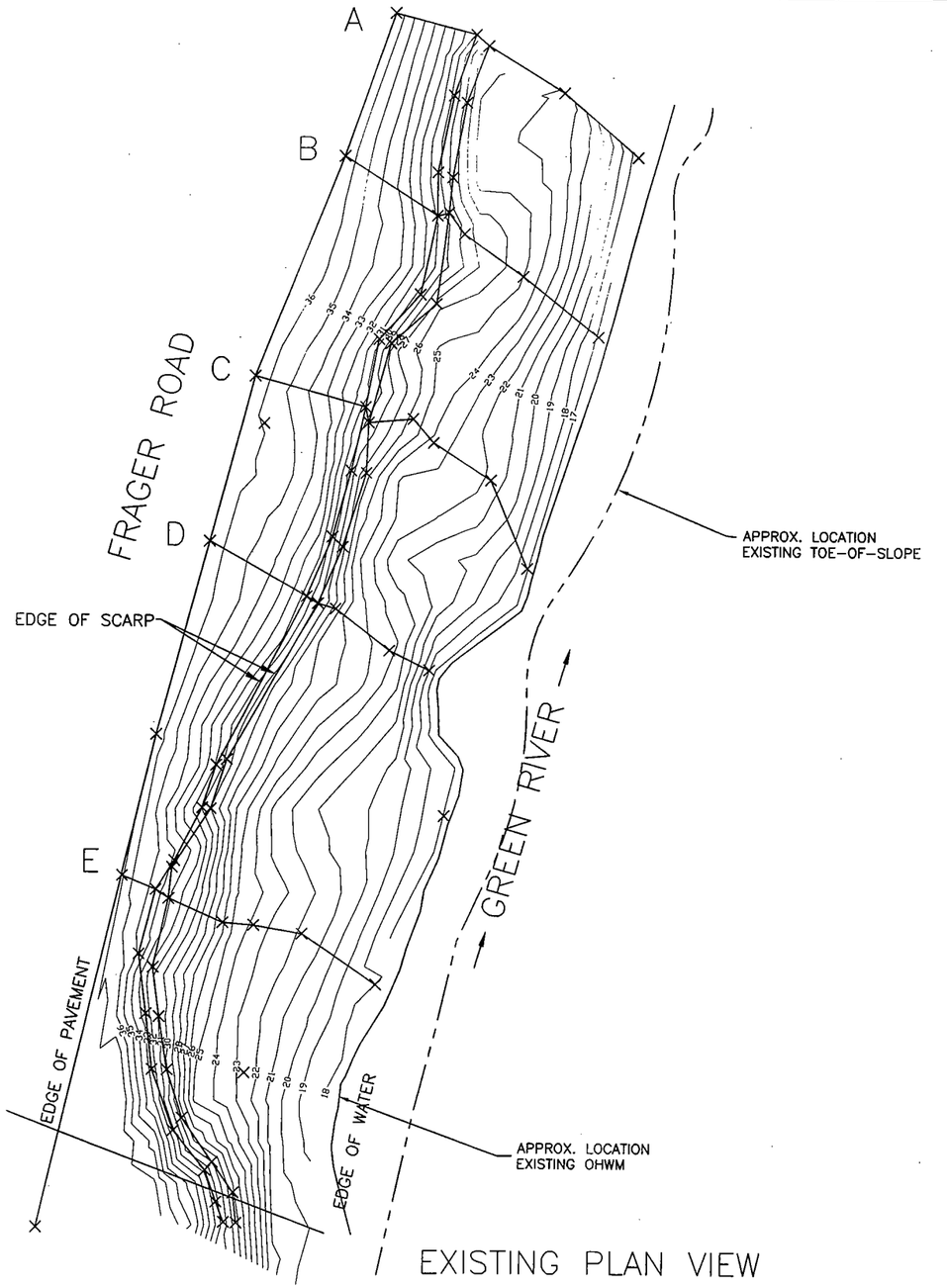
10. Water plants and grass seed as needed, twice a week minimum, until the onset of fall rains.

Equipment Used: PC 225, 230 and 330 track hoes, 10 CY dump trucks, 18 CY belly dump trucks, pickup trucks, 1 ton flatbed trucks, 30' bed trash hauler, hydroseed truck, water truck, and D6 bulldozer.

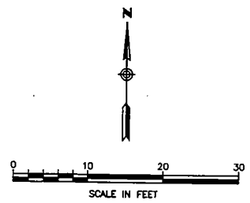
Long Term ESC Monitoring:

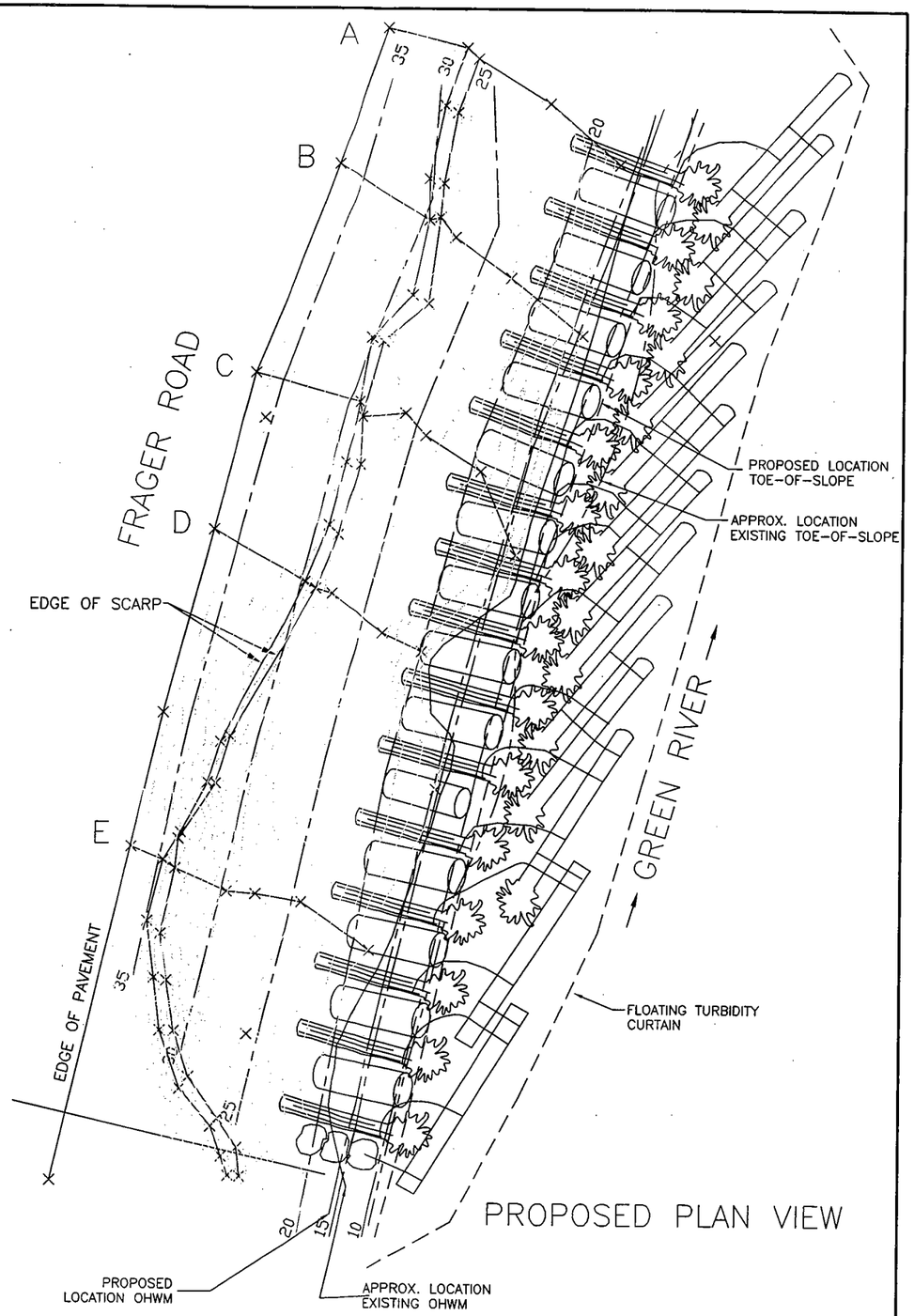
All stabilized slope areas will be monitored for signs of erosion during wet winter months and immediately repaired. Repairs can include straw mulching, straw mulch packing of incipient rills, gravel patching of incised rills, additional placement of topsoil, additional hand- and/or hydroseeding, placement of washed rock filter berms, and localized placement of additional silt fencing. The goal is to maintain a vigorous establishment of dense, deeply rooted erosion control grasses and native riparian vegetation on all disturbed slope areas at all times.

SURVEYED: KC	6/23/99				PROJECT MANAGER: ANDY LEVESQUE	DATE: 1/01	KING COUNTY DEPT. OF NATURAL RESOURCES PAM BISSONNETTE, DIRECTOR WATER AND LAND RESOURCES DIVISION
BASE MAP PLOT:					PROJECT ECOLOGIST: RUTH SCHAEFER	DATE: 1/01	FRAGER ROAD REVETMENT REPAIR
DESIGN PLOT:					DESIGNED: ANDY LEVESQUE	DATE: 1/01	GREEN RIVER, RM 18.5, LB TITLE SHEET
CHECKED:					DRAWN: KEN ZWEIG	DATE: 1/01	SHEET 1 OF 5 SHEETS
FIELD BOOK:							RIVERS SECTION
BY	DATE	REVISION	BY	DATE			



EXISTING PLAN VIEW





PROPOSED PLAN VIEW

SURVEYED: KC	6/23/99				PROJECT MANAGER: ANDY LEVESQUE	DATE: 1/01	
BASE MAP PLOT:					PROJECT ECOLOGIST: RUTH SCHAEFER	DATE: 1/01	
DESIGN PLOT:					DESIGNED: ANDY LEVESQUE	DATE: 1/01	
CHECKED:					DRAWN: KEN ZWEIG	DATE: 1/01	
FIELD BOOK:							
BY	DATE	REVISION	BY	DATE			

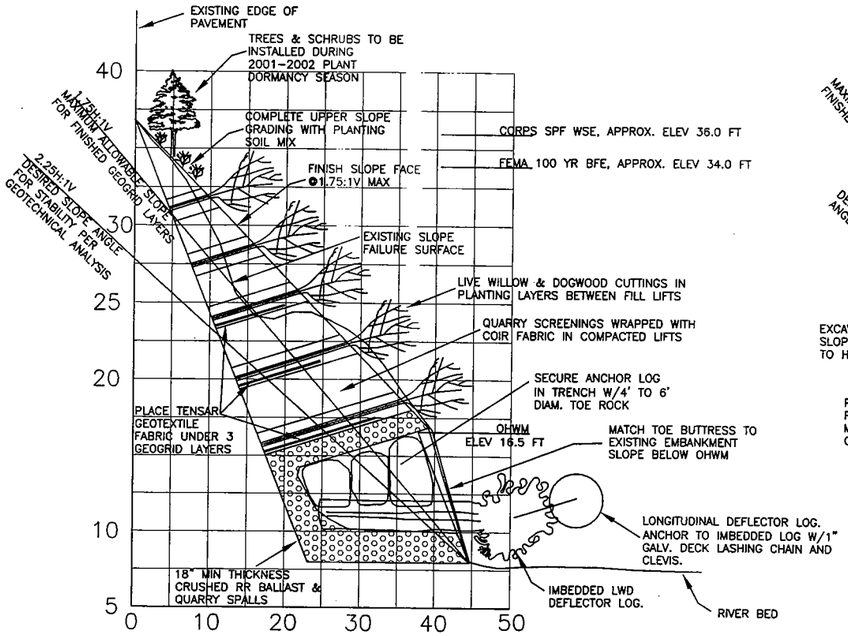
KING COUNTY DEPT. OF NATURAL RESOURCES
PAM BISSONNETTE, DIRECTOR
WATER AND LAND RESOURCES DIVISION

FRAGER ROAD REVETMENT REPAIR

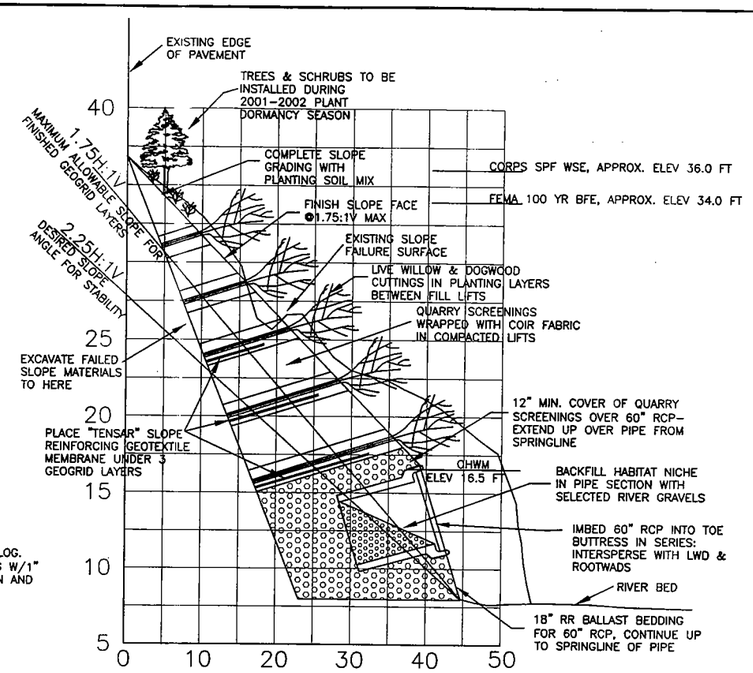
GREEN RIVER, RM 18.5, LB
EXISTING & PROPOSED PLAN VIEW

SHEET 2 OF 5 SHEETS

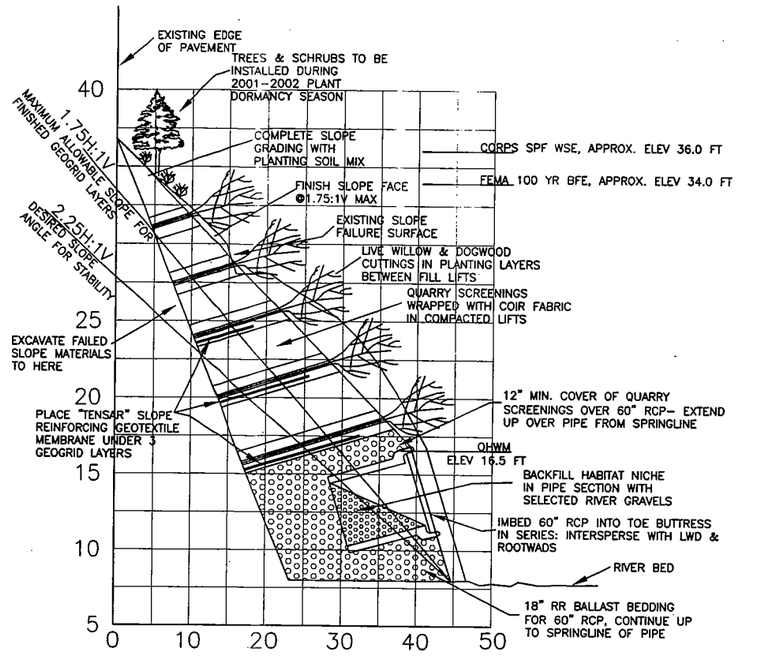
RIVERS SECTION



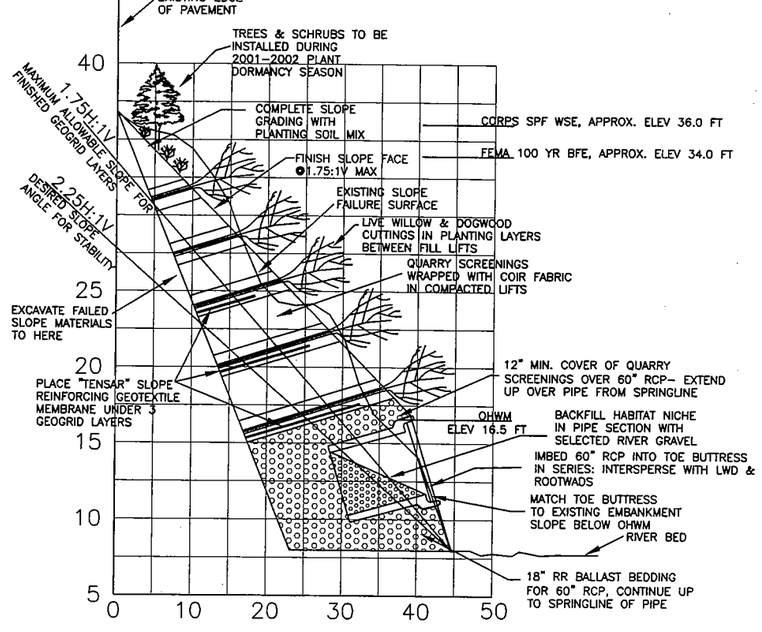
SECTION A



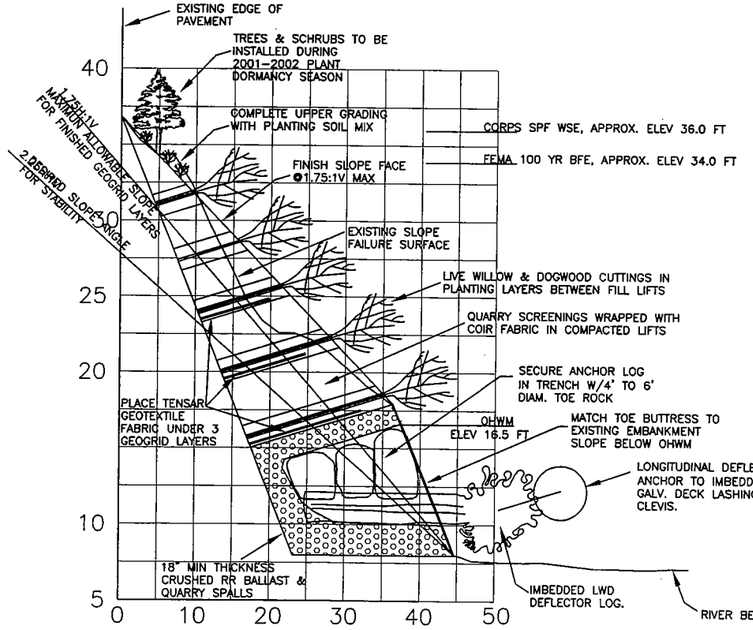
SECTION B



SECTION C



SECTION D



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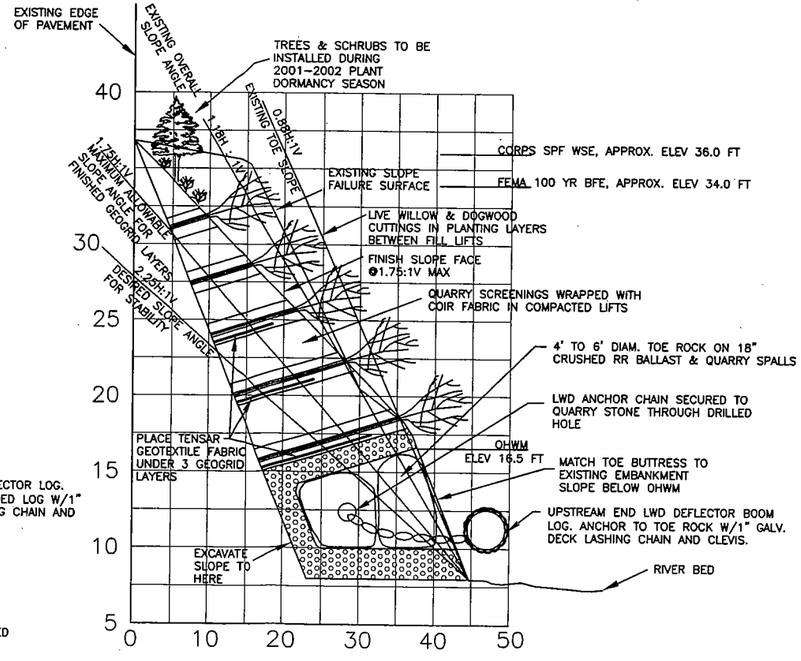


SECTION F

SURVEYED: KC	6/23/99				PROJECT MANAGER: ANDY LEVESQUE	DATE: 1/01	
BASE MAP PLOT:					PROJECT ECOLOGIST: RUTH SCHAEFER	DATE: 1/01	
DESIGN PLOT:					DESIGNED: ANDY LEVESQUE	DATE: 1/01	
CHECKED:					DRAWN: EDNA MACKINNON	DATE: 1/01	
DATUM:							
BY	DATE	REVISION	BY	DATE			

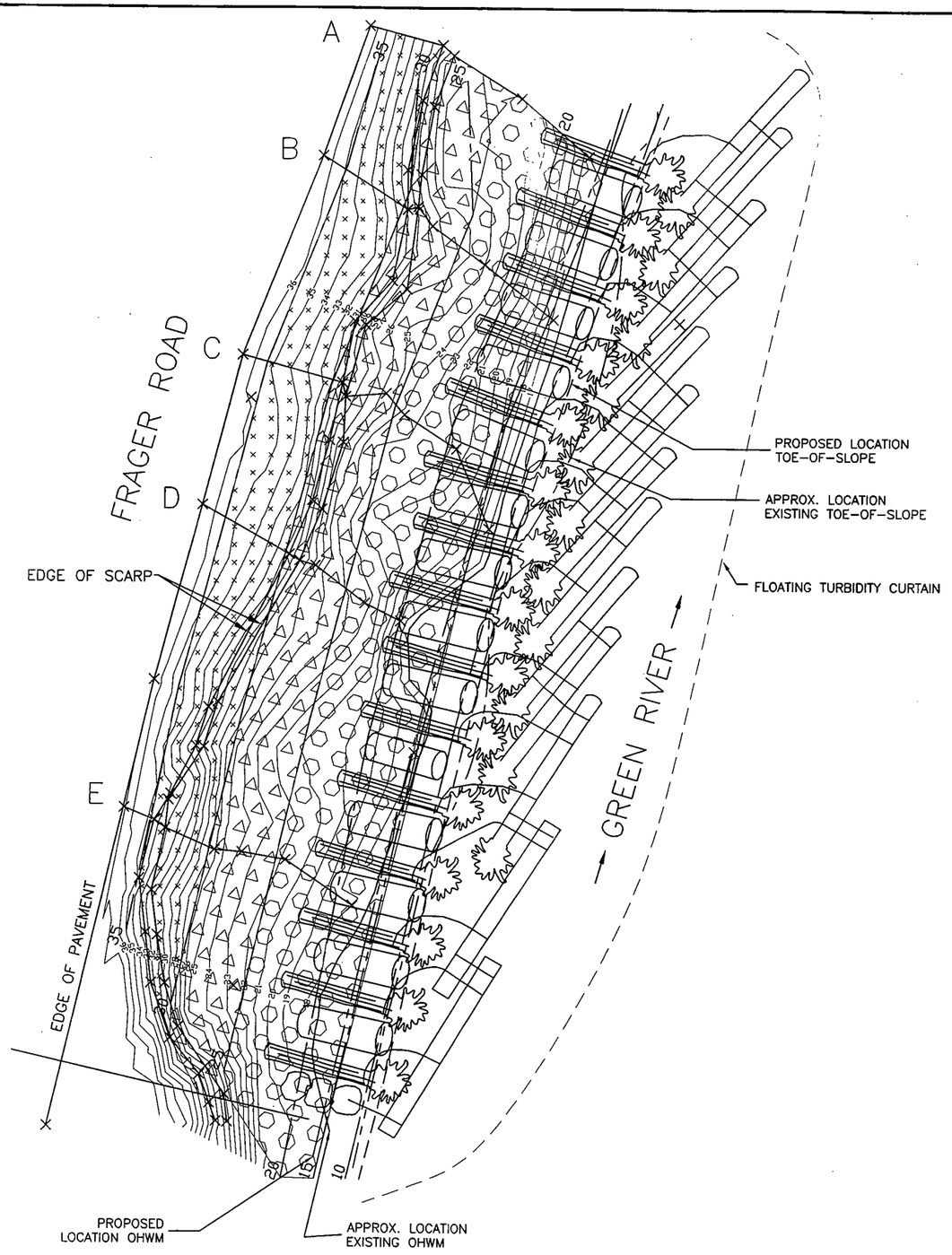
KING COUNTY DEPT. OF NATURAL RESOURCES
PAM BISSONNETTE, DIRECTOR
WATER AND LAND RESOURCES DIVISION

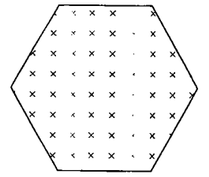
FRAGER ROAD REVETMENT REPAIR

GREEN RIVER, RM 18.5, LB
CROSS SECTIONS

SHEET 3 OF 5 SHEETS

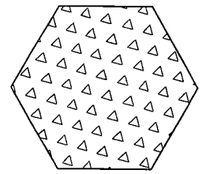
RIVERS SECTION





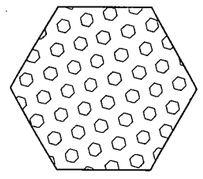
UPPER BANK

Est. 1358 sq. ft.



MIDDLE BANK

Est. 1532 sq. ft.



GEOGRIDS & LOWER BANK

Est. 2614 sq. ft.

SURVEYED: KC	6/23/99				PROJECT MANAGER: ANDY LEVESQUE DATE: 1/01		KING COUNTY DEPT. OF NATURAL RESOURCES PAM BISSONNETTE, DIRECTOR WATER AND LAND RESOURCES DIVISION FRAGER ROAD REVETMENT REPAIR GREEN RIVER, RM 18.5, LB TEMPORARY EROSION AND SEDIMENT CONTROL PLAN VIEW	SHEET 4 OF 5 SHEETS RIVERS SECTION
BASE MAP PLOT:					PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 1/01			
DESIGN PLOT:					DESIGNED: ANDY LEVESQUE DATE: 1/01			
CHECKED:					DRAWN: KEN ZWEIG DATE: 1/01			
FIELD BOOK:								
BY	DATE	REVISION	BY	DATE				

PLANTING SCHEDULE

Total Plants By Species		Common Name	Species Name	Typical Pot Size	Approx. Spacing	Lower Bank	Middle Bank	Upper Bank
			TREES					
5		Bigleaf Maple	Acer macrophyllum	1 gallon	10'+		2	2
5		Red Alder	Alnus rubra	1 gallon	6'+		2	2
17		Oregon Ash	Fraxinus latifolia	1 gallon	6'+		2	
2		Sitka Spruce	Picea sitchensis	1 gallon	10'+		2	
17		Black Cottonwood	Populus trichocarpa	1 gallon	6'+		8	
2		Bitter Cherry	Prunus emarginata	1 gallon	6'+			2
2		Douglas Fir	Pseudotsuga menziesii	1 gallon	10'+			2
17		Western Crabapple	Pyrus fusca	1 gallon	6'+		2	
2		Cascara	Rhamnus purshiana	1 gallon	6'+			2
5		Western Red Cedar	Thuja plicata	1 gallon	6'+		2	2
2		Western Hemlock	Tsuga heterophylla	1 gallon	6'+			2
Total Trees	**77**				**TOTAL**		**23**	**15**
			SHRUBS					
4		Serviceberry	Amelanchier alnifolia	1 gallon	4'+			5
35		Red-osier Dogwood	Cornus stolonifera	1 gallon	4'+	30	5	
4		Western Hazelnut	Corylus cornutus	1 gallon	4'+			5
9		Black Hawthorn	Cratageus douglasii	1 gallon	4'+		5	5
4		Oceanspray	Holodiscus discolor	1 gallon	4"+			5
35		Black Twinberry	Lonicera involucrata	1 gallon	4"+	30	5	
4		Indian Plum	Oemleria cerasiformis	1 gallon	4'+			5
35		Pacific Ninebark	Physocarpus capitatus	1 gallon	4'+	30	5	
4		Red Flowering Current	Ribes sanguineum	1 gallon	3'+			5
9		Nootka Rose	Rosa nutkana	1 gallon	3'+		5	5
9		Baldhip Rose	Rosa pisocarpa	1 gallon	3'+		5	5
4		Thimbleberry	Rubus parviflorus	1 gallon	4'+			5
10		Salmonberry	Rubus spectabilis	1 gallon	4'+		10	
84		Red Elderberry	Sambucus racemosa	1 gallon	2'+		50	35
14		Snowberry	Symphoricarpos alba	1 gallon	4'+		5	10
Total Shrubs	**267**				**TOTAL**	**90**	**95**	**95**

SURVEYED: KC	6/23/99				
BASE MAP PLOT:					
DESIGN PLOT:					
CHECKED:					
FIELD BOOK:					
BY	DATE	REVISION	BY	DATE	

PROJECT MANAGER: ANDY LEVESQUE DATE: 1/01

PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 1/01

DESIGNED: ANDY LEVESQUE DATE: 1/01

DRAWN: KEN ZWEIG DATE: 1/01

KING COUNTY DEPT. OF NATURAL RESOURCES
PAM BISSONNETTE, DIRECTOR
WATER AND LAND RESOURCES DIVISION

FRAGER ROAD REVETMENT REPAIR

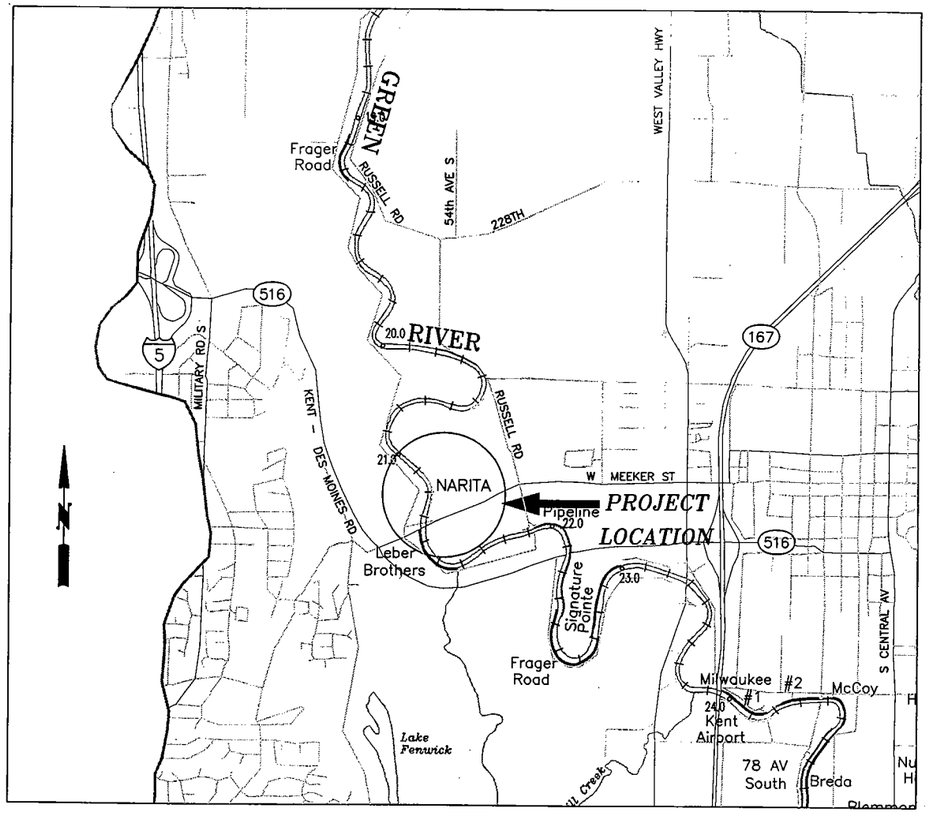
GREEN RIVER, RM 18.5, LB
PLANTING PLAN

SHEET 5 OF 5 SHEETS

RIVERS SECTION

NARITA LEVEE REPAIR

GREEN RIVER, RIVER MILE 21.2 RIGHT BANK



LOCATION MAP

Temporary Erosion and Sediment Control (TESC):

The following will be brought to the site and staged on a daily basis as needed:
* Straw bales for slope mulching
* Silt fencing for perimeter siltation control
* Crushed or washed rock for control of soil pumping on exposed soils in heavy traffic areas
* 5/8 inch minus crushed rock for staging areas and road shoulders
* Pea gravel for filter berms and silt fence installations
* Hand brooms, street sweepers, and wash trucks for control of sediments on paved traffic surfaces

* An undisturbed band of existing vegetation will be left intact along the waterline until excavation of failed or damaged toe buttress areas for installation of crushed rock bedding, toe rock, LWD anchor rocks, and LWD.

* A turbidity curtain will be installed prior to in-water construction

* All in-water construction will occur between June 15 and August 15, 2001, to avoid extended periods of rainy weather and high river discharge, and to coincide with the period of minimum habitat utilization by juvenile and adult salmonids

* All paved traffic areas will be kept free from sediment accumulations by daily sweeping and washing.

* Turbidity will be monitored at the construction site at flagged sampling stations 50 feet upstream from the excavation area and 250 feet downstream from the excavation area to facilitate compliance with limits on turbidity set forth in Washington Department of Ecology Order No. DE 97WQ-007 (February 24, 1997), and at a flagged sampling station located one mile downstream from the site.

Construction Sequence; Toe and Bank Repair:

1. Stake limits of construction area at site.

2. Shape ramps to access bench from existing levee crest upstream and downstream of bench area.

3. Starting at the downstream end of the project, install the floating turbidity curtain in 175-foot-long increments to isolate the instream work area(s) from the flowing stream.

4. Starting at downstream end of the project, construct toe repairs in fifteen foot long (maximum) increments, as follows:

5. Starting at the downstream end of the project, clear and grub existing blackberries and reed canarygrass from the lower bank slope, above the OHWM, in 15 foot increments. Retain the single Alder shown on the plans. Export these plant and soil materials to an approved disposal location (Pacific Topsoil site in Kent or King County Roads Division soil recycling center in Renton).

6. Excavate existing failed levee rip-rap and unsuitable subgrade materials from the lower embankment slopes, above the water surface elevation, in the same 15 foot increment. Export these materials to an approved disposal location (Pacific Topsoil site in Kent or King County Roads Division soil recycling center in Renton).

7. Excavate failed or damaged toe buttress areas and unsuitable subgrade materials from below the water surface elevation for placement of new crushed rock bedding, toe rock, and LWD, in the same 15 foot increments. Working from the embankment side toward the water's edge, leave an intact earthen "plug" at the riverward edge of the toe rock and LWD trench excavation area until the moment of actual toe buttress bedding, LWD, and rock placement in order to minimize turbidity.

8. Excavate and remove the earthen "plug" from along the water's edge, completing the excavation to depth as rapidly as possible. Immediately place 2-1/4" crushed railroad ballast and quarry spalls to stabilize the exposed riverbed and embankment soils, and to provide suitable bedding conditions for placement of toe rock and LWD. Complete this work within the same 15 foot increment.

9. Place LWD within the prepared toe trenches as shown on the plan sheets. Place toe rocks in place to firmly secure the LWD and the entire toe buttress against undercutting erosion, working within the same 15 foot increments as above. Level the top edge of the rock toe buttress at a finished elevation approximately one foot above the OHWM, using light loose rip-rap, 2-1/2" crushed ballast, and 1-1/4" crushed gravel to provide a secure base for subsequent soil lifts and plantings.

10. Using the trackhoe bucket, gently place additional coniferous LWD into the water column, securing them along the bankline to the anchor logs with the chain attachments, and to each other , starting at the downstream end and proceeding upstream. Overlap cut log ends riverward of the next rootwad protruding downstream and secure overlapped logs to each other with additional one-inch diameter anchor chain. The LWD should overlap in a downstream direction as shown on the plan sheets. To the maximum extent, anchoring of the LWD should seek to secure the logs below the OHWM as fully as possible, while minimizing the potential for individual logs to float up, onto the bankline, during flood events. Precise placement of individual LWD pieces will be accomplished under the supervision of the project engineer and the Senior Ecologist.

11. Proceed as specified above in 15 foot increments upstream, relocating the floating turbidity curtain as needed for subsequent portions of the instream work, to the end of the project repair reach.

12. Remove turbidity curtain

Levee slope reconstruction:

1. Following completion of all instream toe buttress construction and LWD placement, place a 3-inch lift of crushed quarry screenings the full length of the toe buttress along the top edge of the newly placed rock. Seal all underlying voids and to create a secure base for subsequent placement of soil lifts and planting layers. Make sure the top surface of the screenings is located at a minimum of six inches above the OHWM elevation.

2. Place an 8-inch layer of Groco-amended planting soil (≥ 20% Groco) along the full length of the bench adjoining the riverbank within the project area, extending for a minimum of eight feet in width. Place a layer of live willow and dogwood cuttings onto the planting soil layer as shown on the cross section drawings. The cuttings will up to 10 feet in length in order to extend the width of the prepared soil lifts. Place additional native riparian shrub and tree species into the exposed edge of the soil lift as specified in the planting schedule. Butt ends of the cuttings can be up to four inches in diameter; exposed ends of the cuttings will extend no more than one foot riverward from the finished slope. Cover the layer of cuttings with an additional 6 to 8 inches of planting soil and compact lightly with a single pass of the trackhoe. Once installed in this manner, each layer of cuttings will be embedded in a one foot minimum thickness of Groco-amended planting soil.

3. Import selected levee fill soils to the site and compact them in eight inch lifts to form fill layers between the layers of live cuttings. Each fill layer will be composed of three compacted soil lifts, extending the full length of the riverbank within the project area. Each finished fill layer will be wrapped with coir fabric for erosion protection.

4. Selected fill soils will be supplemented in lifts with crushed rock materials as noted above during periods of rainfall to provide for adequate compaction and to prevent pumping of mud in areas subject to equipment passage and truck traffic.

5. Alternate willow layers and coir wrapped fill and reconstruct lower embankment slopes to finished grade as shown on the cross section drawings and plan sheet.

6. The lower embankment slope lifts will be brought as close as possible to finished grade and mulched with straw on a daily basis as needed during any anticipated periods of rainy weather.

7. Hydroseed any remaining disturbed soil surfaces following completion of all construction activities.

8. Stake slope areas subject to winter inundation with coir fabric over the completed hydroseed cover as needed to prevent winter erosion.

9. Plant middle and upper slope areas with potted upland native shrubs during the following plant dormancy season (October 1 through March 31) in accordance with planting plan and plant schedule shown on the project drawings.

10. Water plants and grass seed as needed, twice a week minimum, until the onset of fall rains

Equipment Used: PC 225, 230 and 330 track hoes, 10 CY dump trucks, 18 CY belly dump trucks, pickup trucks, 1 ton flatbed trucks, 30' bed trash hauler, hydroseed truck, water truck, and D6 bulldozer.

Long Term ESC Monitoring:

All stabilized slope areas will be monitored for signs of erosion during wet winter months and immediately repaired. Repairs can include straw mulching, straw mulch packing of incipient rills, gravel patching of incised rills, additional placement of topsoil, additional hand- and/or hydroseeding, placement of washed rock filter berms, and localized placement of additional silt fencing. The goal is to maintain a vigorous establishment of dense, deeply rooted erosion control grasses and native riparian vegetation on all disturbed slope areas at all times.

SURVEYED: ENTRANCO	1998				
BASE MAP PLOT: K. ZWEIG	1998				
DESIGN PLOT: E. MACKINNON	1998				
CHECKED: C. LOPER	1998				
FIELD BOOK: ENTRANCO	1998				
BY	DATE	REVISION	BY	DATE	

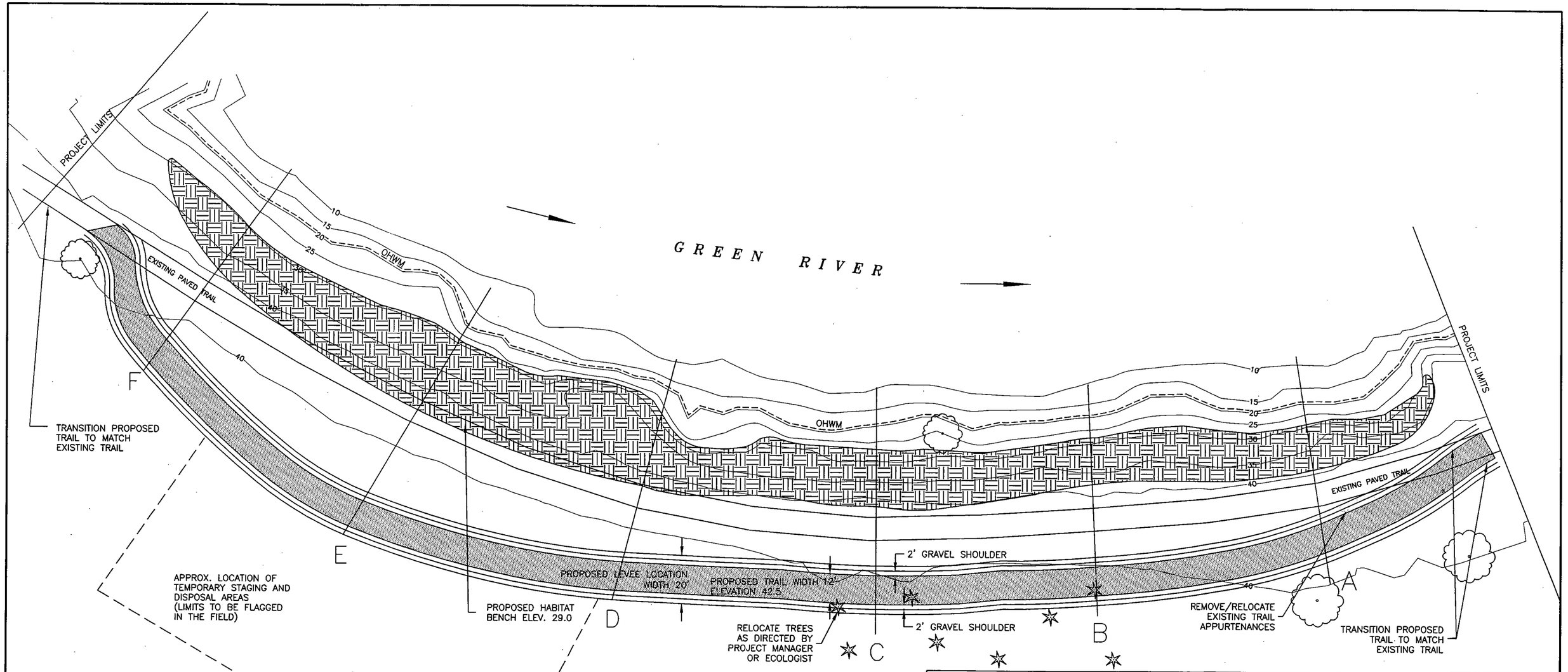
PROJECT MANAGER: ANDY LEVESQUE DATE: 1/01
PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 1/01
DESIGNED: ANDY LEVESQUE DATE: 1/01
DRAWN: KEN ZWEIG DATE: 1/01

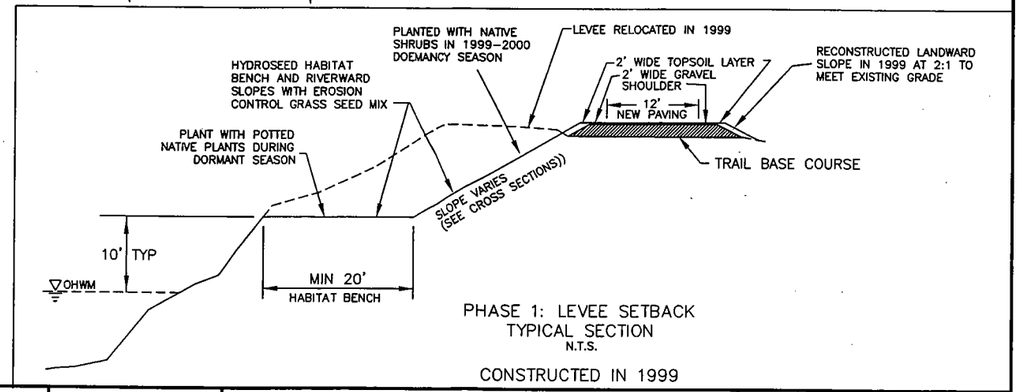
PROJECT No. 091776

KING COUNTY DEPT. OF NATURAL RESOURCES
PAM BISSONNETTE, DIRECTOR
WATER AND LAND RESOURCES DIVISION
NARITA LEVEE REPAIR
GREEN RIVER, RIVER MILE 21.2 R.B.
COVER

SHEET 1 OF 4 SHEETS

RIVERS SECTION





PHASE 1: LEVEE SETBACK
TYPICAL SECTION
N.T.S.

CONSTRUCTED IN 1999

SURVEYED: ENTRANCO	1998				
BASE MAP PLOT: K. ZWEIG	1998				
DESIGN PLOT: E. MACKINNON	1998				
CHECKED: C. LOPER	1998				
FIELD BOOK: ENTRANCO	1998				
BY	DATE	REVISION	BY	DATE	

PROJECT MANAGER: ANDY LEVESQUE DATE: 1/01

PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 1/01

DESIGNED: ANDY LEVESQUE DATE: 1/01

DRAWN: KEN ZWEIG DATE: 1/01

PROJECT No. 091776

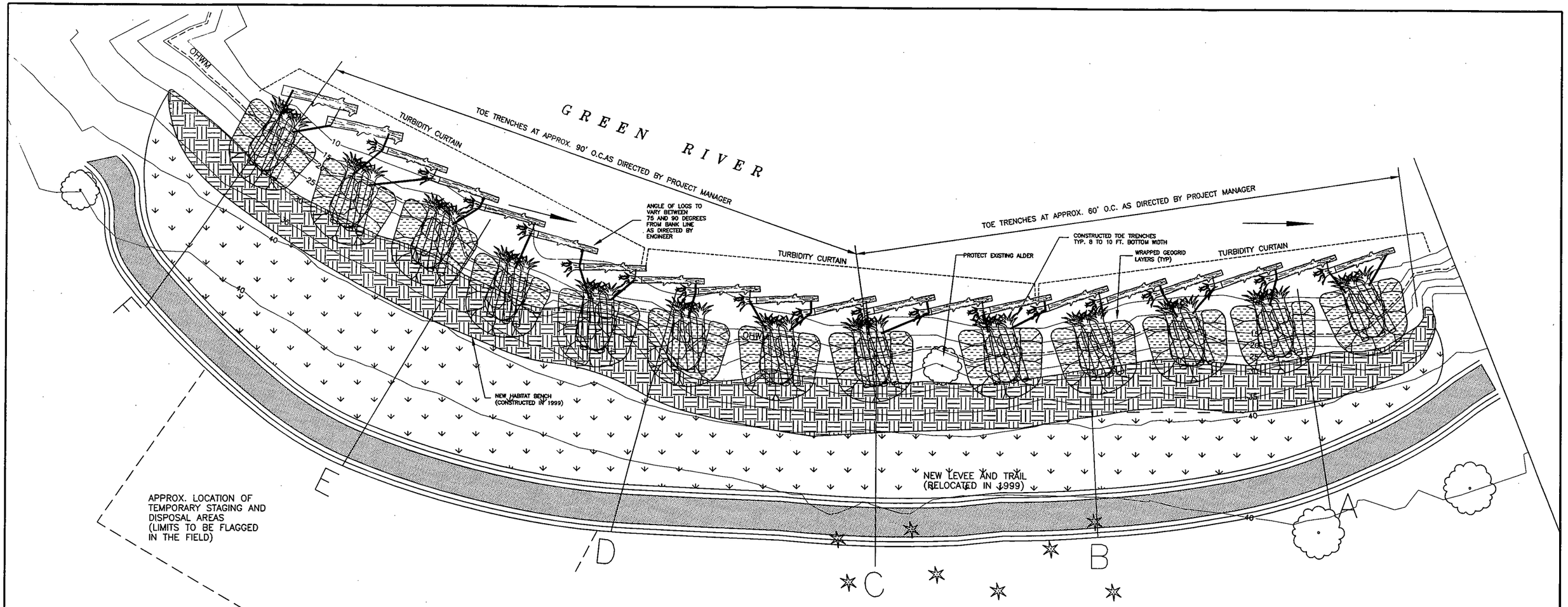
KING COUNTY DEPT. OF NATURAL RESOURCES
PAM BISSONNETTE, DIRECTOR
WATER AND LAND RESOURCES DIVISION

NARITA LEVEE REPAIR

GREEN RIVER RIVER MILE 21.2 R.B.
LEVEE SETBACK – EXISTING PLAN VIEW

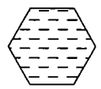
SHEET 2 OF 4 SHEETS

RIVERS SECTION



PLANTING SCHEDULE DETAILS

GEOGRIDS & LOWER BANK

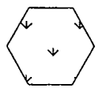


Est. 8,400 sq. ft.

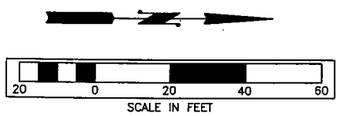
BENCH

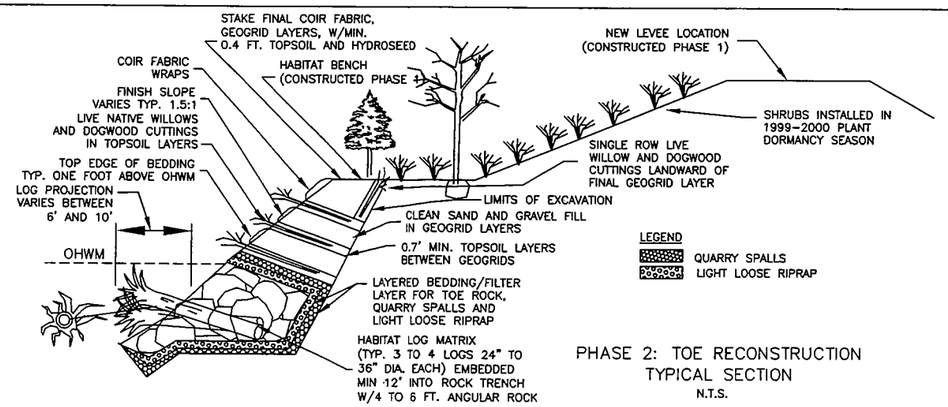
Est. 11,300 sq. ft.

UPPER BANK (Planted in 1999-2000 dormancy season)



Est. 19,300 sq. ft.





PHASE 2: TOE RECONSTRUCTION
TYPICAL SECTION
N.T.S.

SURVEYED: ENTRANCO	1998				PROJECT MANAGER: ANDY LEVESQUE DATE: 1/01	PROJECT No. 091776	KING COUNTY DEPT. OF NATURAL RESOURCES PAM BISSONNETTE, DIRECTOR WATER AND LAND RESOURCES DIVISION NARITA LEVEE REPAIR PHASE II GREEN RIVER RIVER MILE 21.2 R.B. TOE RECONSTRUCTION – PLANTING PLAN
BASE MAP PLOT: K. ZWEIG	1998				PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 1/01		
DESIGN PLOT: E. MACKINNON	1998				DESIGNED: ANDY LEVESQUE DATE: 1/01		
CHECKED: C. LOPER	1998				DRAWN: EDNA MACKINNON DATE: 1/01		
FIELD BOOK: ENTRANCO	1998						
BY	DATE	REVISION	BY	DATE			

SHEET 3 OF 4 SHEETS

RIVERS SECTION

PLANTING SCHEDULE

Common Name	Species Name	Typical Pot Size	Approx. Spacing	Lower Bank	Bench
	TREES				
Bigleaf Maple	Acer macrophyllum	1 gallon	10'+	15	30
Red Alder	Alnus rubra	1 gallon	6'+	15	20
Oregon Ash	Fraxinus latifolia	1 gallon	6'+	25	10
Sitka Spruce	Picea sitchensis	1 gallon	10'+	20	30
Black Cottonwood	Populus trichocarpa	1 gallon	6'+	25	30
Western Crabapple	Pyrus fusca	1 gallon	6'+	10	20
Cascara	Rhamnus purshiana	1 gallon	6'+	5	5
Western Red Cedar	Thuja plicata	1 gallon	6'+	20	30
Western Hemlock	Tsuga heterophylla	1 gallon	6'+	5	5
Total Trees				140	180
	SHRUBS				
Red-osier Dogwood	Cornus stolonifera	1 gallon	4'+	175	50
Western Hazelnut	Corylus cornutus	1 gallon	4'+		25
Black Hawthorn	Cratageus douglasii	1 gallon	4'+	25	25
Oceanspray	Holodiscus discolor	1 gallon	4"+		25
Black Twinberry	Lonicera involucrata	1 gallon	4"+	50	
Pacific Ninebark	Physocarpus capitatus	1 gallon	4'+	50	50
Nootka Rose	Rosa nutkana	1 gallon	3'+		50
Baldhip Rose	Rosa pisocarpa	1 gallon	3'+		50
Red Elderberry	Sambucus racemosa	1 gallon	4'+	100	100
Snowberry	Symphoricarpos alba	1 gallon	4'+		25
Total Shrubs				400	500

		BY	DATE
SURVEYED: ENTRANCO	1998		
BASE MAP PLOT: K. ZWEIG	1998		
DESIGN PLOT: E. MACKINNON	1998		
CHECKED: C. LOPER	1998		
FIELD BOOK: ENTRANCO	1998		
BY	DATE		

REVISION	BY	DATE

PROJECT MANAGER: ANDY LEVESQUE DATE: 1/01

PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 1/01

DESIGNED: ANDY LEVESQUE DATE: 1/01

DRAWN: EDNA MACKINNON DATE: 1/01

PROJECT No. 091776

KING COUNTY DEPT. OF NATURAL RESOURCES
PAM BISSONNETTE, DIRECTOR
WATER AND LAND RESOURCES DIVISION

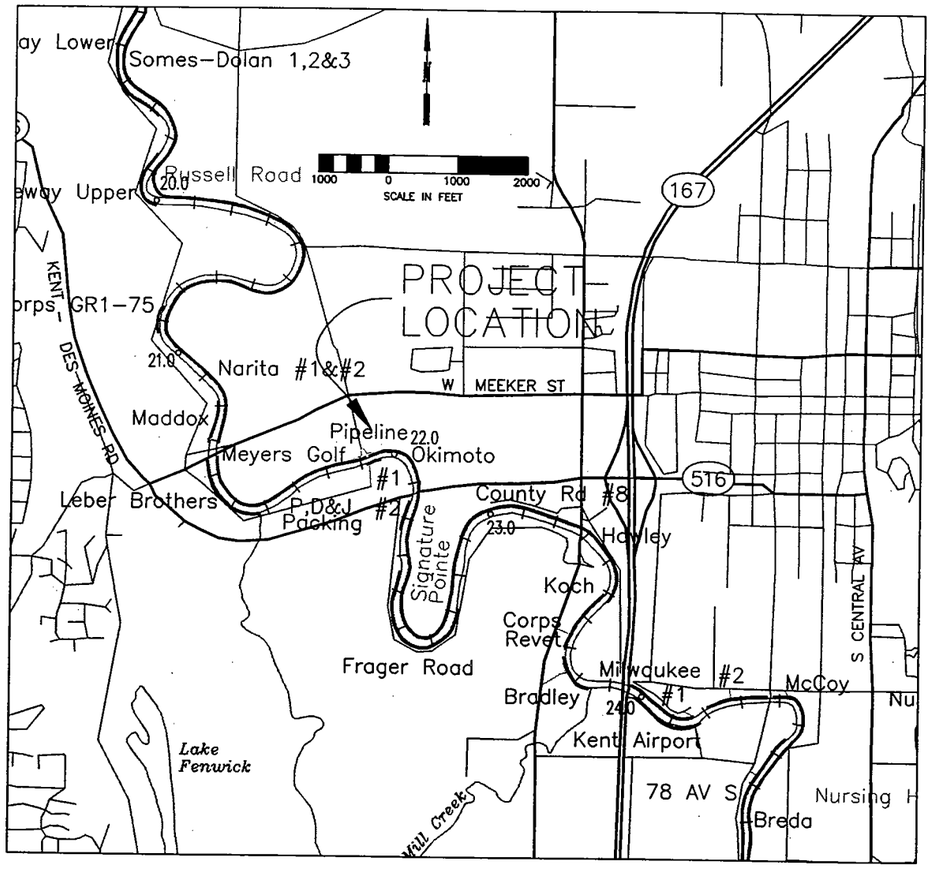
NARITA LEVEE REPAIR PHASE II

GREEN RIVER RIVER MILE 21.2 R.B.
PLANTING SCHEDULE

SHEET 4 OF 4 SHEETS

RIVERS SECTION

PIPELINE LEVEE TOE REPAIR



VICINITY MAP

SEC 23, T22N, R4E

Temporary Erosion and Sediment Control (TESC):

The following will be brought to the site and staged on a daily basis as needed:
* Straw bales for slope mulching
* Silt fencing for perimeter siltation control
* Crushed or washed rock for control of soil pumping on exposed soils in heavy traffic areas
* 5/8 inch minus crushed rock for staging areas and road shoulders .
* Pea gravel for filter berms and silt fence installations
* Hand brooms, street sweepers, and wash trucks for control of sediments on paved traffic surfaces

* An undisturbed band of exdsting vegetation will be left intact along the waterline until excavation of failed or damaged toe buttress areas for installation of crushed rock bedding, toe rock, LWD anchor rocks, habitatembayments, and LWD.

* A turbidity curtain will be installed at the site prior to in-water construction

* All in-water construction will occur between June 15 and August 15, 2001, to avoid extended periods of rainy weather and high river discharge, and to coincide with the period of minimum habitat utilization by juvenile and adult salmonids

* All paved traffic areas will be kept free from sediment accumulations by daily sweeping and washing.

* Turbidity will be monitored at the construction site, at flagged sampling stations 50 feet upstream from the excavation area and 250 feet downstream from the excavation area to facilitate compliance with limits on turbidity set forth in Washington Department of Ecology Order No. DE 97WQ-007 (February 24, 1997), and at a flagged sampling station located one mile downstream from the site.

Construction Sequence; Toe and Bank Repair:

1. Stake limits of construction area at site.

2. Shape ramps to access construction benchcompleted in 1999, from both upstream and downstream of bench area.

3. Starting at the downstream end of the project, install the floating turbidity curtain in 175-foot-long increments to isolate the instream work area(s) from the flowing stream.

4. Starting at downstream end of the project, construct toe repairs in fifteen foot long (maximum) increments, as follows:

5. Starting at the downstream end of the project, clear and grub existing blackberries and reed canarygrass from the lower bank slope, above the OHWM, in 15 foot increments. Export these plant and soil materials to an approved disposal location (Pacific Topsoil site in Kent or King County Roads Division soil recycling center in Renton).

6. Excavate existing failed levee rip-rap and unsuitable subgrade materials from the lower embankment slopes, above the water surface elevation, in the same 15 foot increments. Export these materials to an approved disposal location (Pacific Topsoil site in Kent or King County Roads Division soil recycling center in Renton).

7. Excavate failed or damaged toe buttress areas and unsuitable subgrade materials from below the water surface elevation for placement of new crushed rock bedding, toe rock, and LWD anchor rocks, and for excavation of the habitat embayments as shown on the plan drawings, working in the same 15 foot increments. Working from the embankment side toward the water's edge, leave an intact earthen "plug" at the riverward edge of the toe rock and embayment excavation area until the moment of actual LWD, toe buttress bedding, and toe rock placement in order to minimize turbidity.

8. Excavate and remove the earthen "plug" from along the water's edge, completing the excavation to depth as rapidly as possible. Immediately place 2-1/4" crushed railroad ballast and quarry spalls to stabilize the exposed riverbed and embankment soils, and provide suitable bedding conditions for placement of LWD, anchor rocks, and toe rock. Complete this work within the same 15 foot increments.

9. Shape the habitat embayments and place LWD onto prepared bedding, as shown on the plan drawings. Place additional toe buttress rocks in place to firmly secure the LWD to secure the entire toe buttress against undercutting erosion, working within the same 15 foot increments as above. Level the top edge of the rock toe buttress at a finished elevation approximately one foot above the OHWM, using light loose rip-rap, 2-1/2" crushed ballast, and 1-1/4" crushed gravel to provide a secure base for subsequent soil lifts and plantings.

10. Using the trackhoe bucket, gently place the additional coniferous LWDs into the water column, securing them along the bankline to the imbedded LWD with the chain attachments, and to each other, starting at the downstream end and proceeding upstream. Overlap cut log ends riverward of the next rootwad protruding downstream and secure overlapped logs to each other with additional one-inch diameter anchor chain. The LWD should overlap in a downstream direction as shown on the plan sheets. To the maximum extent, anchoring of the LWD should seek to secure the logs below the OHWM as fully as possible, while minimizing the potential for individual logs to float up onto the bankline, during flood events. Precise placement of individual LWD pieces will be accomplished under the supervision of the project engineer and the Senior Ecologist.

11. Proceed as specified above in 15 foot increments upstream, relocating the floating turbidity curtain as needed for subsequent portions of the instream work, to the end of the project repair reach.

12. Remove turbidity curtain.

Levee slope reconstruction:

1. Following completion of all instream toe buttress construction and LWD placement, place a 3-inch lift of crushed quarry screenings the full length of the toe buttress along the top edge of the newly placed rock, logs, and around the margins of the habitat embayments. Seal all underlying voids and to create a secure base for subsequent placement of soil lifts and planting layers. Make sure the top surface of the screenings is located at a minimum of six inches above the OHWM elevation, in order to guarantee survival of the cuttings during the spring gowing season.

2. Place an 8-inch layer of Groco-amended planting soil (≥ 20% Groco) along the full length of the bench adjoining the riverbank within the project area, extending for a minimum of eight feet in width. Place a layer of live willow and dogwood cuttings onto the planting soil layer as shown on the cross section drawings. The cuttings will up to 10 feet in length in order to extend the width of the prepared soil lifts. Place additional native riparian shrub and tree species into the exposed edge of the soil lift as specified in the planting schedule. Butt ends of the cuttings can be up to four inches in diameter; exposed ends of the cuttings will extend no more than one foot riverward from the finished slope. Cover the layer of cuttings with an additional 6 to 8 inches of planting soil and compact lightly with a single pass of the trackhoe. Once installed in this manner, each layer of cuttings will be embedded in a one foot minimum thickness of Groco-amended planting soil.

3. Import selected levee fill soils to the site and compact them in eight inch lifts to form fill layers between the layers of live cuttings. Each fill layer will be composed of three compacted soil lifts, extending the full length of the riverbank within the project area. Each finished fill layer will be wrapped with coir fabric for erosion protection.

4. Selected fill soils will be supplemented in lifts with crushed rock materials as noted above during periods of rainfall to provide for adequate compaction and to prevent pumping of mud in areas subject to equipment passage and truck traffic.

5. Alternate willow layers and coir wrapped fill and reconstruct the embankment slopes to finished grade as shown on the cross section drawings and plan sheet.

6. The embankment slope lifts will be brought as close as possible to finished grade and mulched with straw on a daily basis as needed during any anticipated periods of rainy weather.

7. Hydroseed any remaining disturbed soil surfaces following completion of all construction activities.

8. Stake slope areas subject to winter inundation with coir fabric over the completed hydroseed cover as needed to prevent winter erosion.

9. Plant middle and upper slope areas with upland native shrubs during the following plant dormancy season (October 1 through March 31) in accordance with planting plan and plant schedule shown on the project drawings.

10. Water plants and grass seed as needed, twice a week minimum, until the onset of fall rains

Equipment Used: PC 225, 230 and 330 track hoes, 10 CY dump trucks, 18 CY belly dump trucks, pickup trucks, 1 ton flatbed trucks, 30' bed trash hauler, hydroseed truck, water truck, and D6 bulldozer.

Long Term ESC Monitoring:

All stabilized slope areas will be monitored for signs of erosion during wet winter months and immediately repaired. Repairs can include straw mulching, straw mulch packing of incipient rills, gravel patching of incised rills, additional placement of topsoil, additional hand- and/or hydroseeding, placement of washed rock filter berms, and localized placement of additional silt fencing. The goal is to maintain a vigorous establishment of dense, deeply rooted erosion control grasses and native riparian vegetation on all disturbed slope areas at all times.

SURVEYED: ENTRANCO	6-8-98				PROJECT MANAGER: ANDY LEVESQUE	DATE: 1/01	
BASE MAP PLOT:					PROJECT ECOLOGIST: RUTH SCHAEFER	DATE: 1/01	
DESIGN PLOT:					DESIGNED: ANDY LEVESQUE	DATE: 1/01	
CHECKED:					DRAWN: JOHN SMALL	DATE: 1/01	
DATUM:							
BY	DATE	REVISION	BY	DATE			

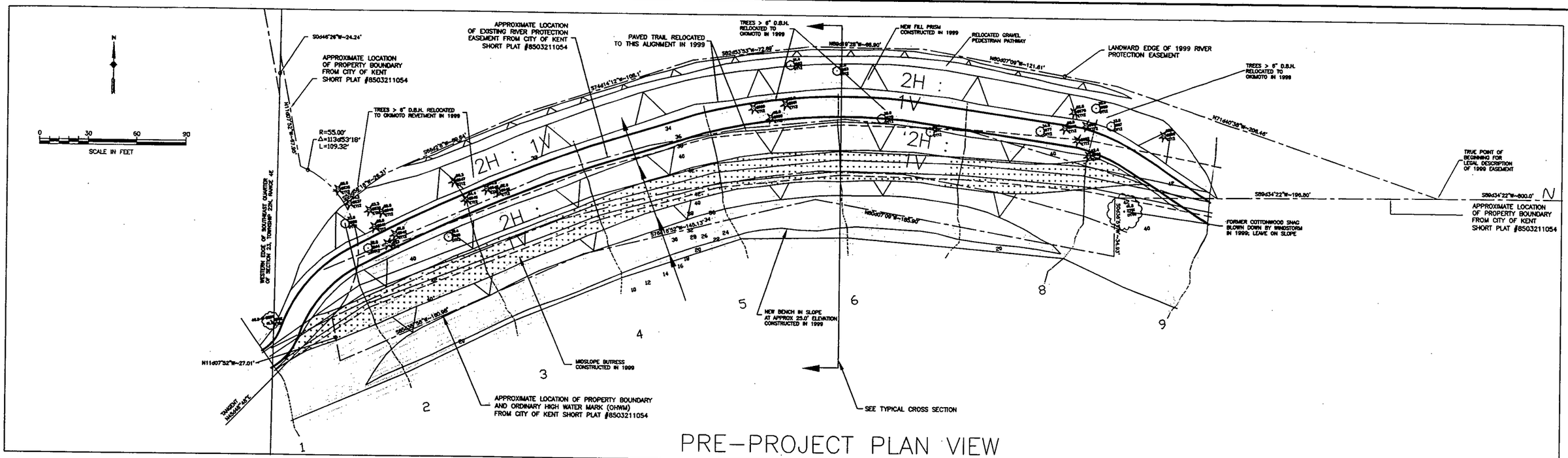
PROJECT No. 091762

KING COUNTY DEPARTMENT OF NATURAL RESOURCES
PAM BISSONNETTE, DIRECTOR
WATER AND LAND RESOURCES DIVISION

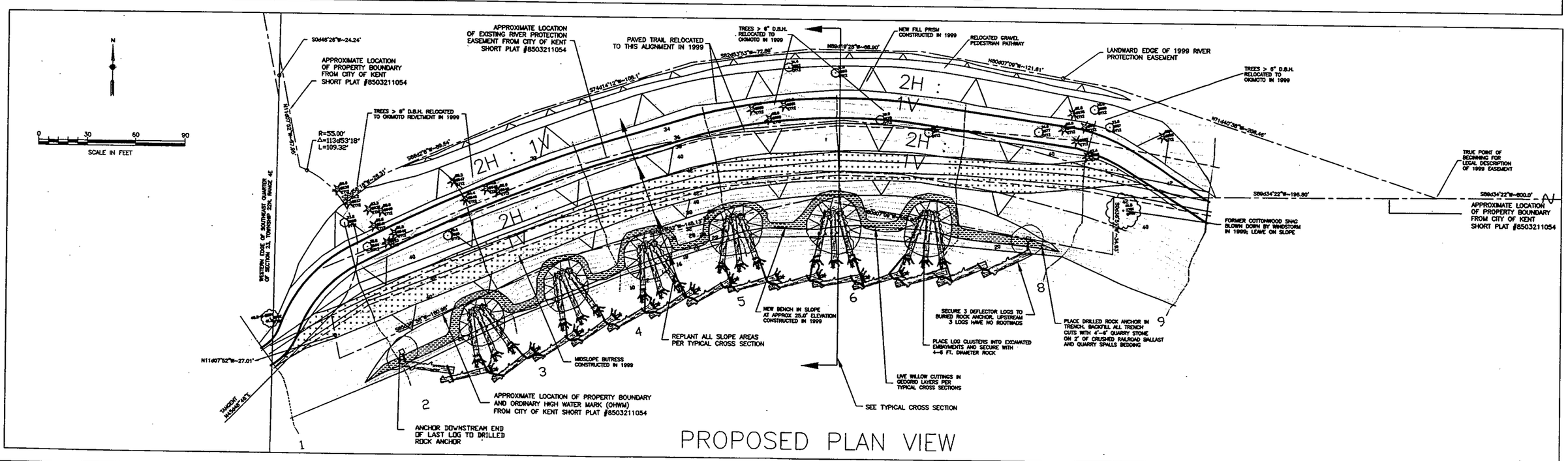
PIPELINE LEVEE TOE REPAIR
GREEN RIVER, RM 21.9, RB
COVER SHEET

SHEET 1 OF 4 SHEETS

RIVERS SECTION

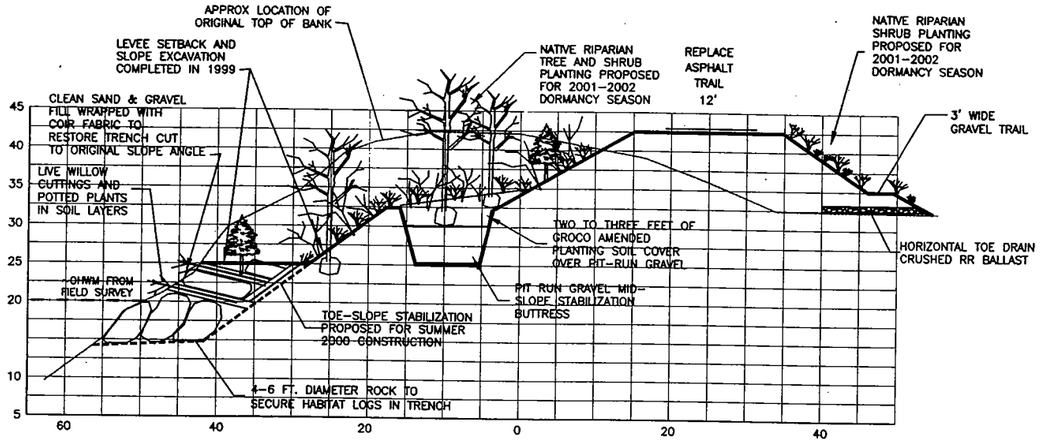


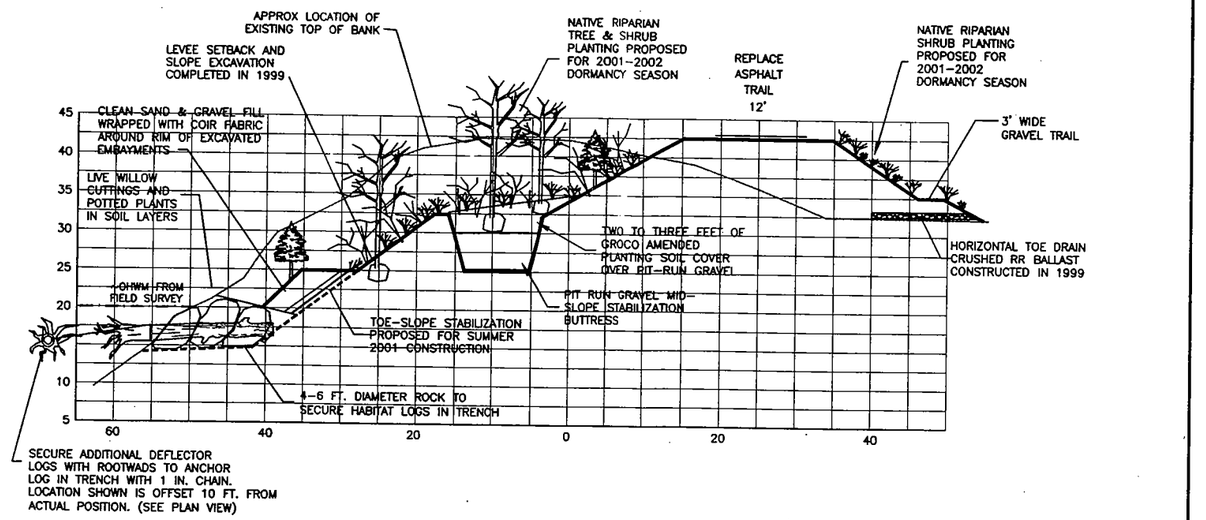
PRE-PROJECT PLAN VIEW



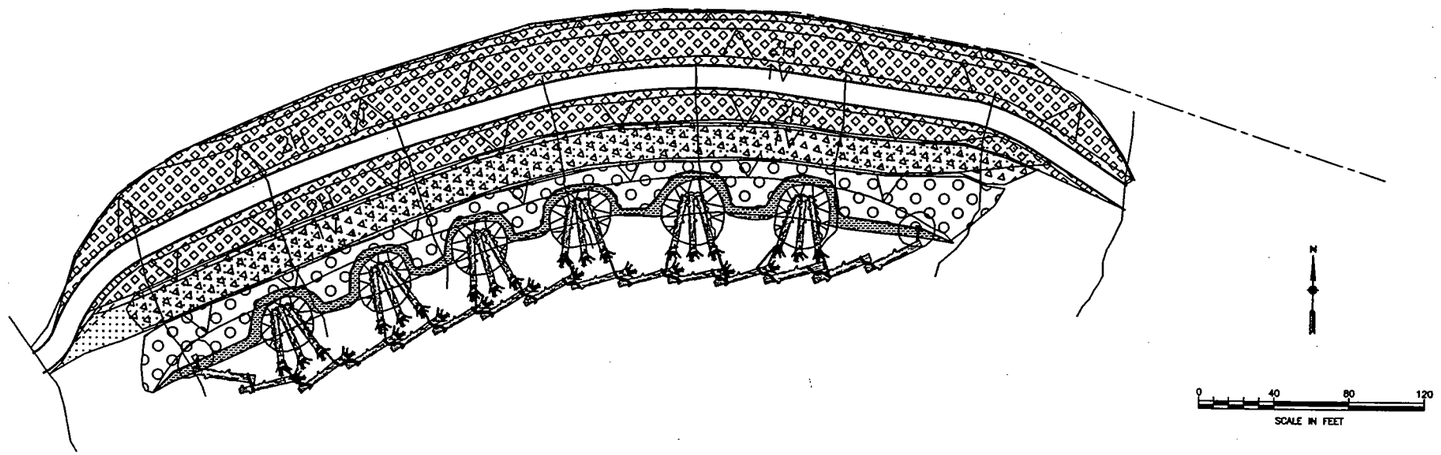
PROPOSED PLAN VIEW

SURVEYED: ENTRANCO	6-8-98				PROJECT MANAGER: ANDY LEVESQUE DATE: 1/01			KING COUNTY DEPT. OF NATURAL RESOURCES PAM BISSONNETTE, DIRECTOR WATER AND LAND RESOURCES DIVISION
BASE MAP PLOT:					PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 1/01			PIPELINE LEVEE TOE REPAIR GREEN RIVER, RM 21.9, RB EXISTING & PROPOSED PLAN VIEWS
DESIGN PLOT:					DESIGNED: ANDY LEVESQUE DATE: 1/01			SHEET 2 OF 4 SHEETS
CHECKED:					DRAWN: KEN ZWEIG DATE: 1/01			RIVERS SECTION
FIELD BOOK:								
BY	DATE	REVISION	BY	DATE	PROJECT No. 091762			



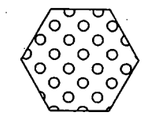


PLANTING PLAN



PLANTING SCHEDULE DETAILS

GEOGRIDS & LOWER BANK

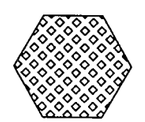


Est. 4,500 sq. ft.

BENCH

Est. 5,000 sq. ft.

UPPER BANK



Est. 14,000 sq. ft.

SURVEYED: ENTRANCO 6-8-98				PROJECT MANAGER: ANDY LEVESQUE DATE: 1/01	PROJECT No. 091762		KING COUNTY DEPT. OF NATURAL RESOURCES PAM BISSONNETTE, DIRECTOR WATER AND LAND RESOURCES DIVISION PIPELINE LEVEE TOE REPAIR GREEN RIVER, RM 21.9, RB TYPICAL CROSS SECTIONS & PLANTING	SHEET 3 OF 4 SHEETS RIVERS SECTION
BASE MAP PLOT:				PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 1/01				
DESIGN PLOT:				DESIGNED: ANDY LEVESQUE DATE: 1/01				
CHECKED:				DRAWN: KEN ZWEIG DATE: 1/01				
FIELD BOOK:								
BY DATE	REVISION	BY	DATE					

PLANTING SCHEDULE

Total Plants By Species		Common Name	Species Name	Typical Pot Size	Approx. Spacing	Lower Bank	Bench	Upper Bank
			TREES					
10		Bigleaf Maple	Acer macrophyllum	1 gallon	10'+		10	
10		Red Alder	Alnus rubra	1 gallon	6'+		10	
10		Oregon Ash	Fraxinus latifolia	1 gallon	6'+	0	10	
20		Sitka Spruce	Picea sitchensis	1 gallon	10'+		20	
20		Black Cottonwood	Populus trichocarpa	1 gallon	6'+	0	20	
0		Bitter Cherry	Prunus emarginata	1 gallon	6'+			
0		Douglas Fir	Pseudotsuga menziesii	1 gallon	10'+			
10		Western Crabapple	Pyrus fusca	1 gallon	6'+	0	10	
0		Cascara	Rhamnus purshiana	1 gallon	6'+			
20		Western Red Cedar	Thuja plicata	1 gallon	6'+		20	
0		Western Hemlock	Tsuga heterophylla	1 gallon	6'+			
Total Trees	**100**				**TOTAL**	**0**	**100**	
			SHRUBS					
125		Serviceberry	Amelanchier alnifolia	1 gallon	4'+			125
500		Red-osier Dogwood	Cornus stolonifera	1 gallon	4'+	400	100	
125		Western Hazelnut	Corylus cornutus	1 gallon	4'+			125
175		Black Hawthorn	Crataegus douglasii	1 gallon	4'+		50	125
175		Oceanspray	Holodiscus discolor	1 gallon	4"+		50	125
250		Black Twinberry	Lonicera involucrata	1 gallon	4"+	200	50	
50		Indian Plum	Oemleria cerasiformis	1 gallon	4'+			50
250		Pacific Ninebark	Physocarpus capitatus	1 gallon	4'+	200	50	
50		Red Flowering Current	Ribes sanguineum	1 gallon	3'+			50
175		Nootka Rose	Rosa nutkana	1 gallon	3'+		50	125
175		Baldhip Rose	Rosa pisocarpa	1 gallon	3'+		50	125
150		Thimbleberry	Rubus parviflorus	1 gallon	4'+			150
150		Salmonberry	Rubus spectabilis	1 gallon	4'+			150
800		Red Elderberry	Sambucus racemosa	1 gallon	2'+		100	700
250		Snowberry	Symphoricarpos alba	1 gallon	4'+		100	150
Total Shrubs	**3400**				**TOTAL**	**800**	**600**	**2000**

SURVEYED: ENTRANCO	6-8-98				
BASE MAP PLOT:					
DESIGN PLOT:					
CHECKED:					
FIELD BOOK:					
BY	DATE	REVISION	BY	DATE	

PROJECT MANAGER: ANDY LEVESQUE DATE: 1/01

PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 1/01

DESIGNED: ANDY LEVESQUE DATE: 1/01

DRAWN: KEN ZWEIG DATE: 1/01

PROJECT No. 091762

KING COUNTY DEPT. OF NATURAL RESOURCES
PAM BISSONNETTE, DIRECTOR
WATER AND LAND RESOURCES DIVISION

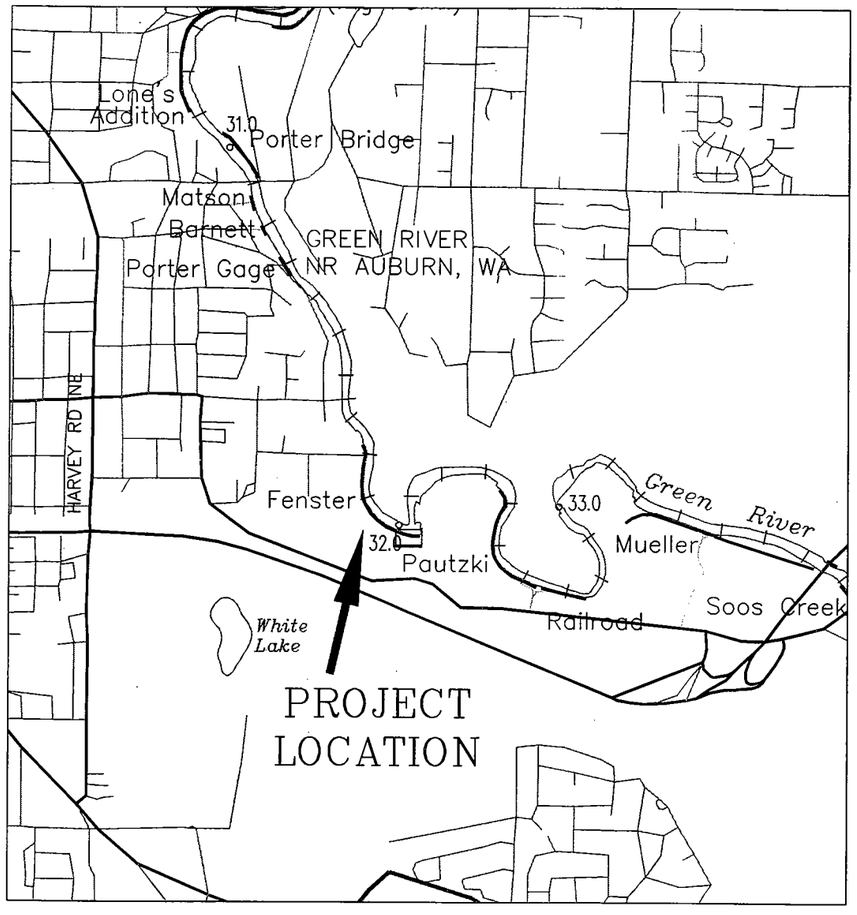
PIPELINE LEVEE TOE REPAIR

GREEN RIVER, RM 21.9, RB
PLANTING PLAN

SHEET 4 OF 4 SHEETS

RIVERS SECTION

FENSTER REVETMENT REPAIR



Temporary Erosion and Sediment Control (TESC):

The following will be brought to the site and staged on a daily basis as needed:
*Straw bales for slope mulching
*Silt fencing for perimeter siltation control
*Crushed or washed rock for control of soil pumping on exposed soils in heavy traffic areas
*5/8 inch minus crushed rock for staging areas and road shoulders
*Pea gravel for filter berms and silt fence installations
*Hand brooms, street sweepers, and wash trucks for control of sediments on paved traffic surfaces.

An undisturbed band of existing vegetation will be left intact along the waterline until excavation of failed or damaged toe buttress areas for installation of crushed rock bedding, toe rock, LWD anchor rocks, and LWD.

A turbidity curtain will be installed at the site prior to in-water construction.

All in-water construction will occur between June 15 and August 15, 2001, to avoid extended periods of rainy weather and high river discharge, and to coincide with the period of minimum habitat utilization by juvenile and adult salmonids.

All paved traffic areas will be kept free from sediment accumulations by daily sweeping and washing.

Turbidity will be monitored at the construction site, at flagged sampling stations 50 feet upstream from the excavation area and 250 feet downstream from the excavation area to facilitate compliance with limits on turbidity set forth in Washington Department of Ecology Order No. DE 97WQ-007 (February 24, 1997), and at a flagged sampling station located one mile downstream from the site.

Construction Sequence; Toe and Bank Repair:

1. Stake limits of construction area at site.

2. Trench silt fence into riverbank slope, at lower limits of construction bench area, leaving an intact band of undisturbed vegetation downslope from the silt fence location, extending to the OHWM. Also install silt fence around landward edge of construction area.

3. Place pea gravel berm to anchor silt fence into trench.

4. Excavate upper embankment slopes to create and shape ramps to access construction bench excavation area, from both upstream and downstream of bench area.

5. Operating from the upper bank and from the ramps as needed, excavate the construction bench, landward of the silt fence.

6. Starting at the downstream end of the project, install the floating turbidity curtain in 175-foot-long increments to isolate the instream work area(s) from the flowing stream.

7. Starting at downstream end of the project, construct toe repairs in fifteen foot long (maximum) increments, as follows:

8. Starting at the downstream end of the project, clear and grub existing blackberries and reed canarygrass from the lower bank slope, above the OHWM, in 15 foot increments. Export these plant and soil materials to an approved disposal location (Pacific Topsoil site in Kent or King County Roads Division soil recycling center in Renton).

9. Excavate existing failed levee rip-rap and unsuitable subgrade materials from the lower embankment slopes, above the water surface elevation, in the same 15 foot increments. Export these materials to an approved disposal location (Pacific Topsoil site in Kent or King County Roads Division soil recycling center in Renton).

10. Excavate failed or damaged toe buttress areas and unsuitable subgrade materials from below the water surface elevation for placement of new crushed rock bedding, toe rock, and LWD anchor rocks, in the same 15 foot increment. Working from the embankment side toward the water's edge, leave an intact earthen "plug" at the riverward edge of the toe rock and LWD trench excavation area until the moment of actual LWD, toe buttress bedding and rock placement in order to minimize turbidity.

11. Excavate and remove the earthen "plug" from along the water's edge, completing the excavation to depth as rapidly as possible. Immediately place 2-1/4" crushed railroad ballast and quarry spalls to stabilize the exposed riverbed and embankment soils, and to provide suitable bedding conditions for placement of LWD and toe rock. Complete this work within the same 15 foot increments.

12. Place LWD within the prepared toe trench bedding area at a 15 foot spacing, as shown on the plan drawings. Place additional toe buttress rocks in place to firmly secure the LWD and the entire toe buttress against undercutting erosion, working within the same 15 foot increments as above. Level the top edge of the rock toe buttress at a finished elevation approximately one foot above the OHWM, using light loose rip-rap, 2-1/2" crushed ballast, and 1-1/4" crushed gravel to provide a secure base for subsequent soil lifts and plantings.

13. Using the trackhoe bucket, gently place the additional coniferous LWD into the water column, securing them along the bankline to the imbedded LWD with the chain attachments, and to each other, starting at the downstream end and proceeding upstream. Overlap cut log ends riverward of the next rootwad protruding downstream and secure overlapped logs to each other with additional one-inch diameter anchor chain. The LWD should overlap in a downstream direction as shown on the plan sheets. To the maximum extent, anchoring of the LWD should seek to secure the logs below the OHWM as fully as possible, while minimizing the potential for individual logs to float up, onto the bankline, during flood events. Precise placement of individual LWD pieces will be accomplished under the supervision of the project engineer and the Senior Ecologist.

14. Proceed as specified above in 15 foot increments upstream, relocating the floating turbidity curtain as needed for subsequent portions of the instream work, to the end of the project repair reach.

15. Remove turbidity curtain

Levee slope reconstruction:

1. Following completion of all instream toe buttress construction and LWD placement, place a 3-inch lift of crushed quarry screenings the full length of the toe buttress along the top edge of the newly placed rock. Seal all underlying voids and to create a secure base for subsequent placement of soil lifts and planting layers. Make sure the top surface of the screenings is located at a minimum of six inches above the OHWM elevation.

2. Excavate the bulk of the remaining revetment fill and remove the culvert from the historic swale at the site. Overexcavate slopes as shown on the drawings by a distance of six feet to allow for placement of clean gravels surrounding the logs, and for placement of willow layers and geogrid fills.

3. Install the log spillway into the excavated area of the historic swale and key into place with four to six foot diameter quarry stone. Dress the top edges of the log and anchor rock installations smooth and level with additional placement of quarry spalls, crushed railroad ballast, and quarry screenings to create a level surface for placement of the geogrid and planting layers. Bury the centerline of the swale excavation and surround the exposed logs to a depth of six feet with clean gravels, measuring approximateley 1/4 inch to 4 inches in diameter. Departures from these gravel dimensions may be authorized in the field at the time of construction by the Senior Ecologist at the site.

4. Place an 8-inch layer of Groco-amended planting soil (> 20% Groco) along the full length of the bench adjoining the riverbank, and along both banks extending for a minimum of eight feet in width. Place a layer of live willow and dogwood cuttings onto the planting soil layer as shown on the cross section drawings. The cuttings will up to 10 feet in length in order to extend the width of the prepared soil lifts. Place additional native riparian shrub and tree species into the exposed edge of the soil lift as specified in the planting schedule. Butt ends of the cuttings can be up to four inches in diameter; exposed ends of the cuttings will extend no more than one foot riverward from the finished slope. Cover the layer of cuttings and potted plants with an additional 6 to 8 inches of planting soil and compact lightly with a single pass of the trackhoe. Once installed in this manner, each layer of cuttings will be embedded in a one foot minimum thickness of Groco-amended planting soil.

5. Import selected levee fill soils to the site and compact them in eight inch lifts to form fill layers between the layers of live cuttings and potted plants. Each fill layer will be composed of three compacted soil lifts, extending the full length of the riverbank and the full extent of the recreated swale outlet, within the project area. Each finished fill layer will be wrapped with coir fabric for erosion protection.

6. Selected fill soils will be supplemented in lifts with crushed rock materials as noted above during periods of rainfall to provide for adequate compaction and to prevent pumping of mud in areas subject to equipment passage and truck traffic.

7. Alternate willow and planting layers with coir wrapped fill layers and reconstruct lower and upper embankment slopes to finished grade as shown on the cross section drawings and plan sheet.

8. The embankment slope lifts will be brought as close as possible to finished grade and mulched with straw on a daily basis as needed during any anticipated periods of rainy weather.

9. Hydroseed any remaining disturbed soil surfaces following completion of all construction activities.

10. Stake slope areas subject to winter inundation with coir fabric over the completed hydroseed cover as needed to prevent winter erosion.

11. Plant bench and upper slope areas with potted native plants during the following plant dormancy season (October 1 through March 31) in accordance with planting plan and plant schedule shown on the project drawings.

12. Water plants and grass seed as needed, twice a week minimum, until the onset of fall rains.

Equipment Used: PC 225, 230 and 330 track hoes, 10 CY dump trucks, 18 CY belly dump trucks, pickup trucks, 1 ton flatbed trucks, 30' bed trash hauler, hydroseed truck, water truck, and D6 bulldozer.

Long Term ESC Monitoring:

All stabilized slope areas will be monitored for signs of erosion during wet winter months and immediately repaired. Repairs can include straw mulching, straw mulch packing of incipient rills, gravel patching of incised rills, additional placement of topsoil, additional hand- and/or hydroseeding, placement of washed rock filter berms, and localized placement of additional silt fencing. The goal is to maintain a vigorous establishment of dense, deeply rooted erosion control grasses and native riparian vegetation on all disturbed slope areas at all times.

SURVEYED: J. SMALL & K. ZWEIG
BASE MAP PLOT: E. Mac kINNON
DESIGN PLOT: E. Mac KINNON
CHECKED: A. LEVESQUE
DATUM: NAVD 88

BY DATE

REVISION BY DATE

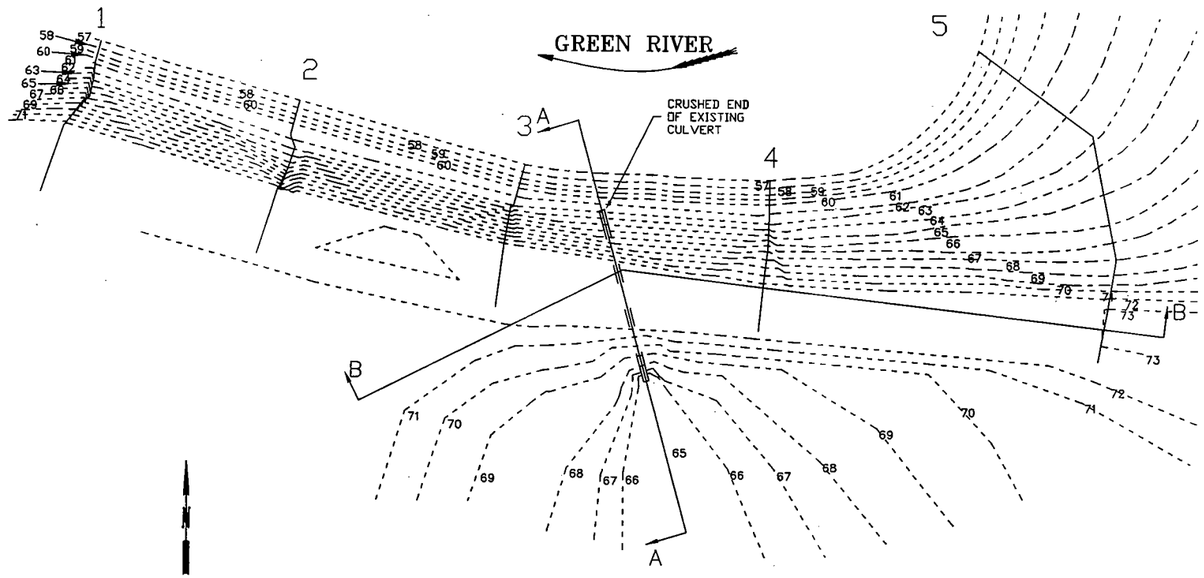
PROJECT MANAGER: A. LEVESQUE DATE: 1/01
PROJECT ECOLOGIST: R. SCHAEFER DATE: 1/01
DESIGNED: A. LEVESQUE DATE: 1/01
DRAWN: J. SMALL DATE: 1/01

KING COUNTY DEPARTMENT OF NATURAL RESOURCES
PAM BISSONNETTE, DIRECTOR
WATER AND LAND RESOURCE DIVISION
FENSTER REVETMENT REPAIR
RIVER MILE 32.0
PROPOSED PLAN

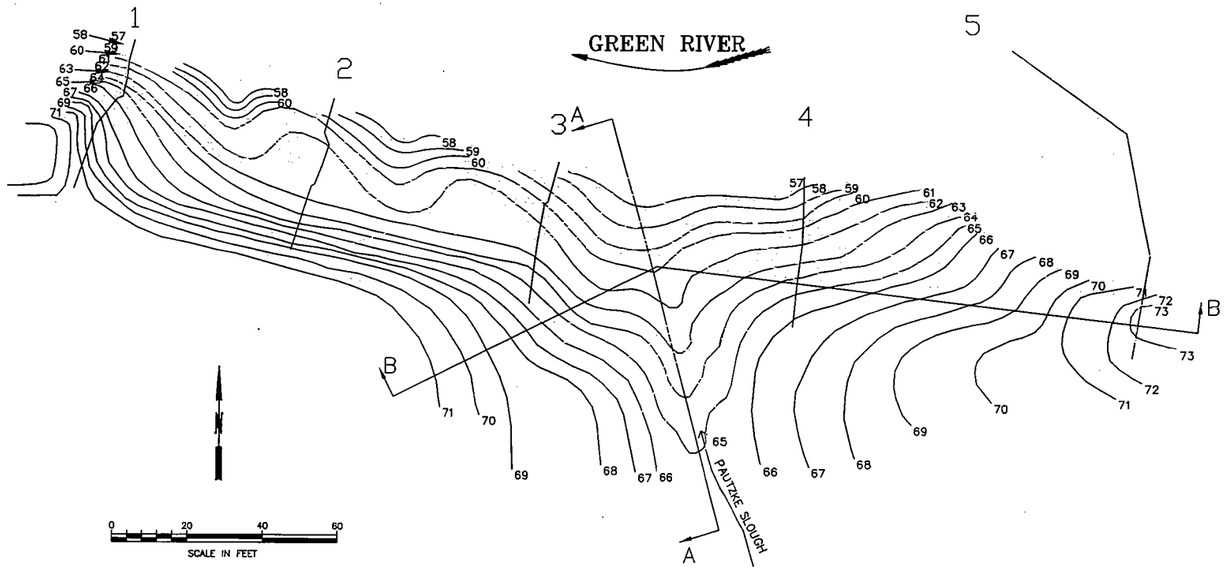
SHEET 1 OF 7 SHEETS

RIVERS SECTION

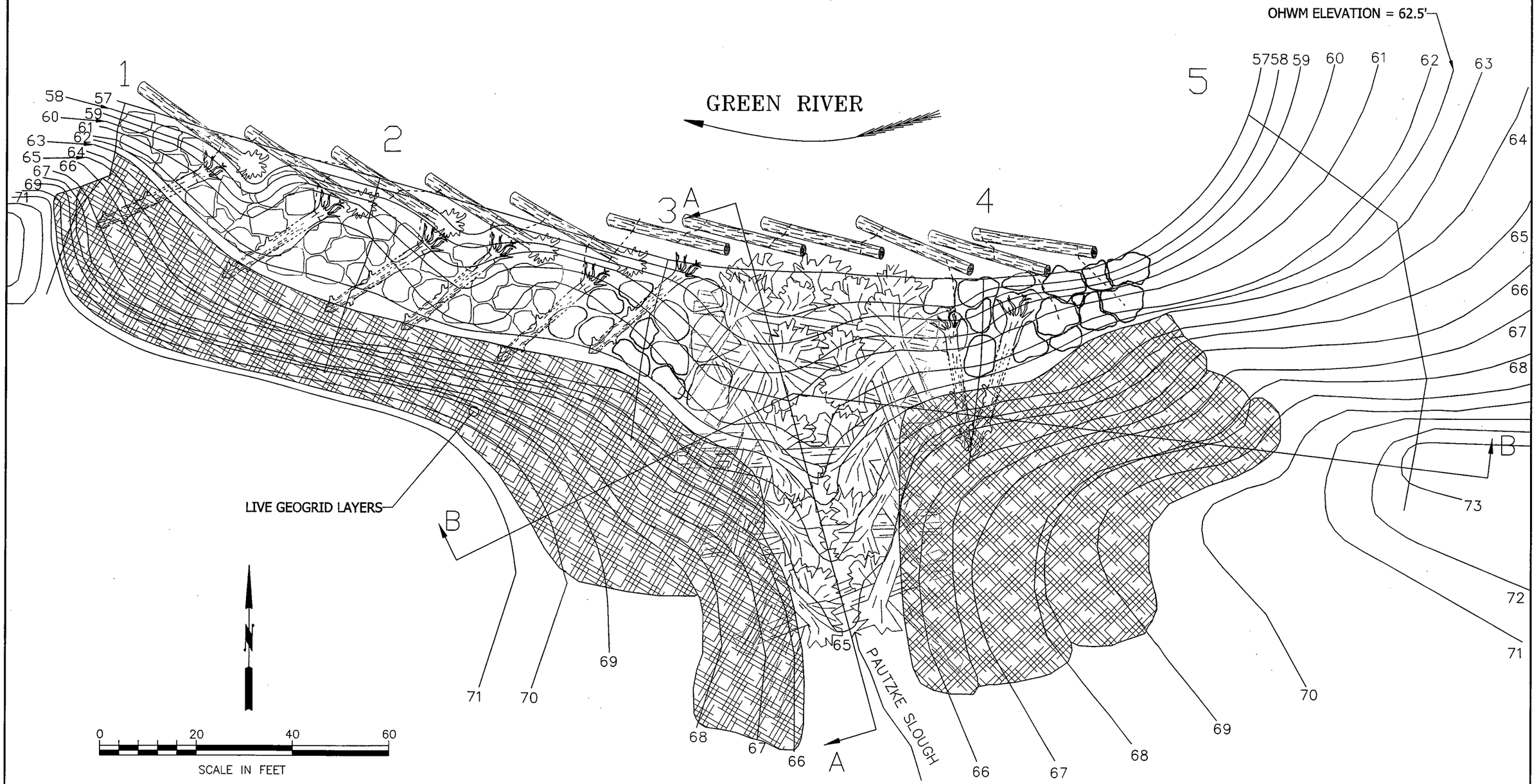
FENSTER EXISTING CONDITIONS



FENSTER PROPOSED GRADING



SURVEYED: J. SMALL & K. ZWEIG				PROJECT MANAGER: A. LEVESQUE DATE: 1/01			KING COUNTY DEPARTMENT OF NATURAL RESOURCES PAM BISSONNETTE, DIRECTOR WATER AND LAND RESOURCE DIVISION FENSTER REVETMENT REPAIR RIVER MILE 32.0 EXISTING GRADE PLAN VIEW	SHEET 2 OF 7 SHEETS RIVERS SECTION
BASE MAP PLOT: E. Mac KINNON				PROJECT ECOLOGIST: R. SCHAEFER DATE: 1/01				
DESIGN PLOT: E. Mac KINNON				DESIGNED: A. LEVESQUE DATE: 1/01				
CHECKED: A. LEVESQUE				DRAWN: J. SMALL DATE: 1/01				
DATUM: NAVD 88								
BY DATE	REVISION	BY	DATE					

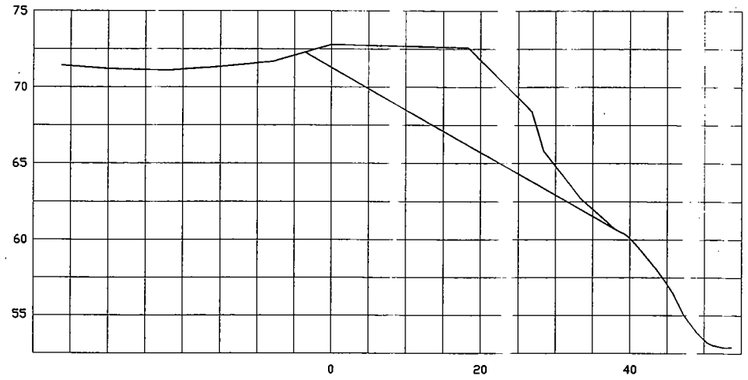


FENSTER REVETMENT REPAIR
PROPOSED PLAN VIEW

SURVEYED: J. SMALL & K. ZWEIG				PROJECT MANAGER: A. LEVESQUE DATE: 1/01		KING COUNTY DEPARTMENT OF NATURAL RESOURCES	SHEET 3 OF 7 SHEETS
BASE MAP PLOT: E. Mac KINNON				PROJECT ECOLOGIST: R. SCHAEFER DATE: 1/01		PAM BISSONNETTE, DIRECTOR	
DESIGN PLOT: E. Mac KINNON				DESIGNED: A. LEVESQUE DATE: 1/01		WATER AND LAND RESOURCE DIVISION	
CHECKED: A. LEVESQUE				DRAWN: J. SMALL DATE: 1/01		FENSTER REVETMENT REPAIR	
DATUM: NAVD 88						RIVER MILE 32.0	
BY DATE	REVISION	BY	DATE			PROPOSED PLAN	RIVERS SECTION

FENSTER REVETMENT REPAIR

1



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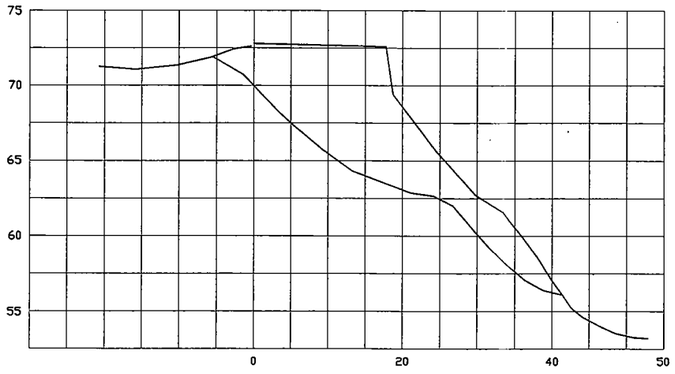

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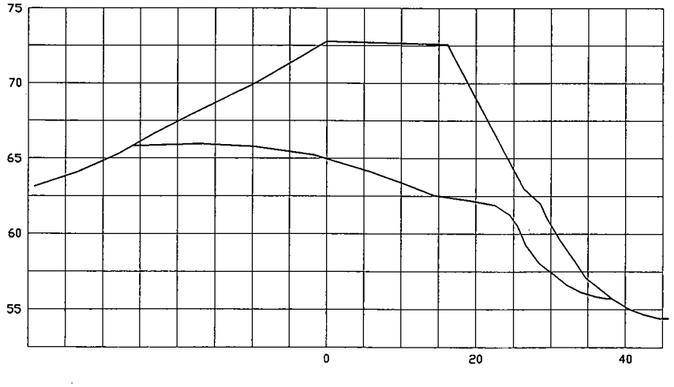

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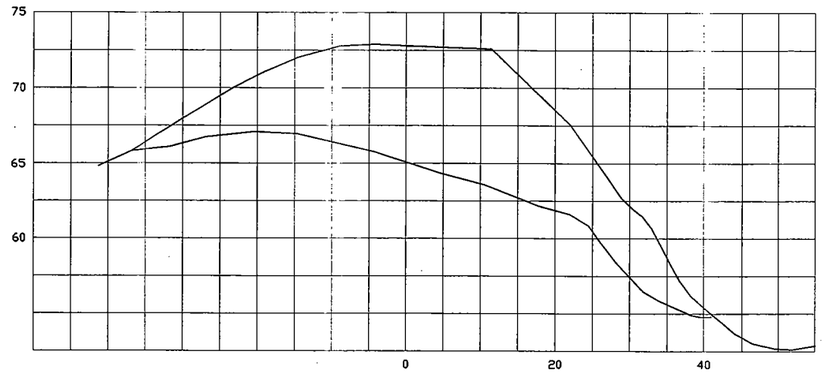

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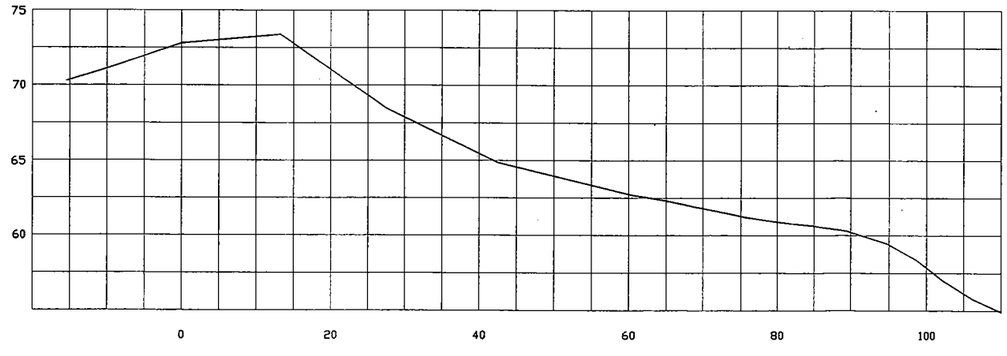
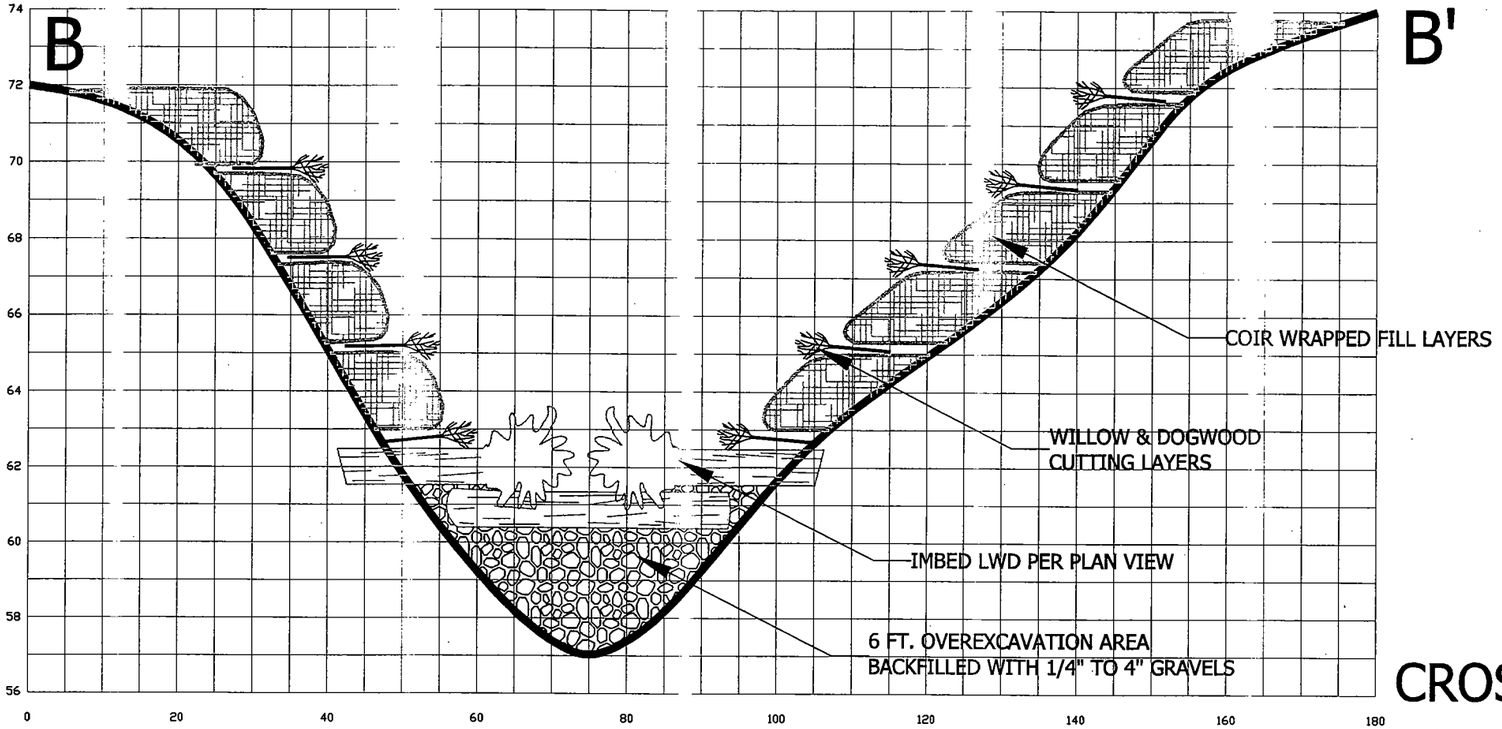
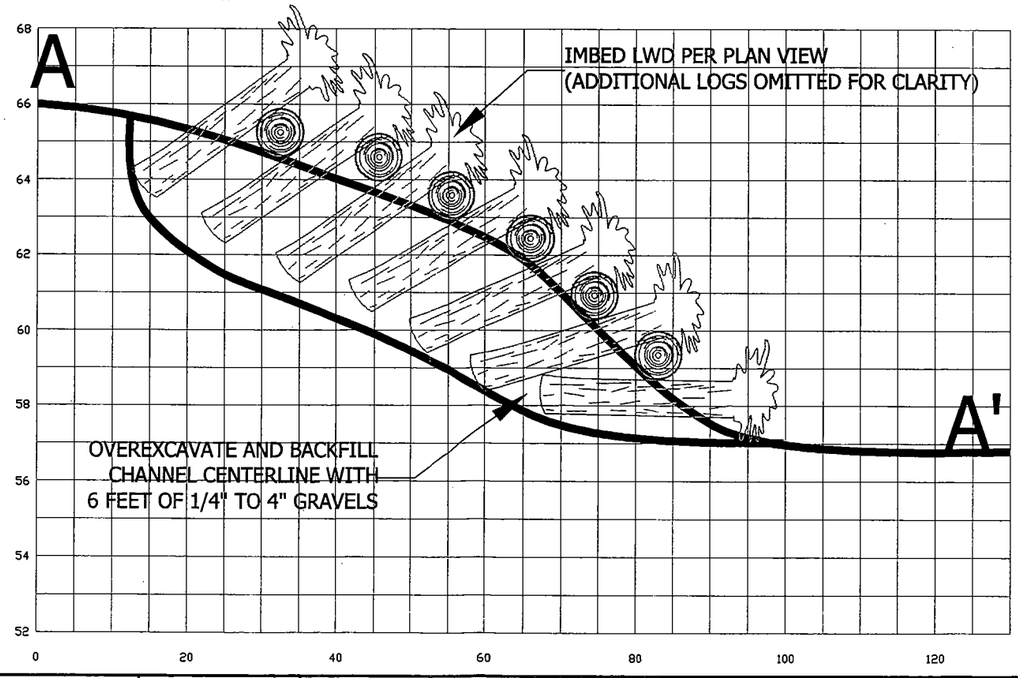


SURVEYED: J. SMALL & K. ZWEIG BASE MAP PLOT: E. Mac KINNON DESIGN PLOT: E. Mac KINNON CHECKED: A. LEVESQUE DATUM: NAVD 88 BY DATE	REVISION BY DATE	PROJECT MANAGER: ANDY LEVESQUE DATE: 1/01 PROJECT ECOLOGIST: RUTH SCHAEFER DATE: 1/01 DESIGNED: ANDY LEVESQUE DATE: 1/01 DRAWN: JOHN SMALL DATE: 1/01	DECLARATION No. _____ 11/95 DAMAGE SURVEY REPORT DECLARATION No. _____ 2/96 DAMAGE SURVEY REPORT PROJECT No. _____ MAINTENANCE DIVISION No. _____			KING COUNTY DEPARTMENT OF NATURAL RESOURCES PAM BISSONNETTE, DIRECTOR WATER AND LAND RESOURCES DIVISION FENSTER REVETMENT REPAIR RIVER MILE 32.0 CROSS SECTIONS	SHEET 4 OF 7 SHEETS RIVERS SECTION



CROSS-SECTION B-B'

CROSS-SECTION A-A'



SURVEYED: J. SMALL & K. ZWEIG			
BASE MAP PLOT: E. Mac kINNON			
DESIGN PLOT: E. Mac KINNON			
CHECKED: A. LEVESQUE			
DATUM: NAVD 88			
BY DATE	REVISION	BY	DATE

PROJECT MANAGER: A. LEVESQUE DATE: 1/01

PROJECT ECOLOGIST: R. SCHAEFER DATE: 1/01

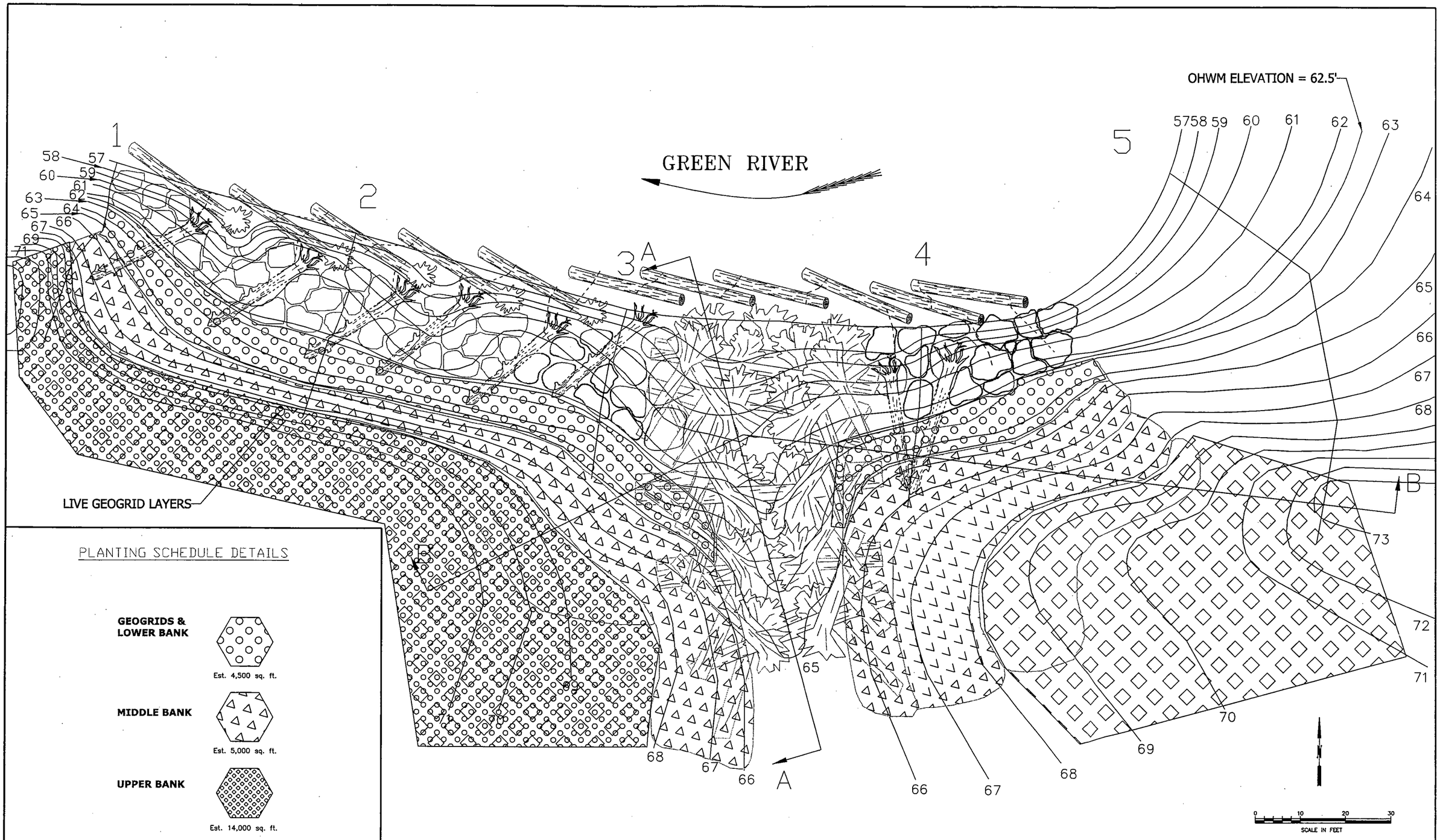
DESIGNED: A. LEVESQUE DATE: 1/01

DRAWN: J. SMALL DATE: 1/01

KING COUNTY DEPARTMENT OF NATURAL RESOURCES
PAM BISSONNETTE, DIRECTOR
WATER AND LAND RESOURCES DIVISION
FENSTER REVETMENT REPAIR
RIVER MILE 32.0
EXISTING CONDITIONS

SHEET 5 OF 7 SHEETS

RIVERS SECTION



PLANTING SCHEDULE DETAILS

GEOGRIDS & LOWER BANK

Est. 4,500 sq. ft.

MIDDLE BANK

Est. 5,000 sq. ft.

UPPER BANK

Est. 14,000 sq. ft.

SURVEYED: J. SMALL & K. ZWEIG			PROJECT MANAGER: A. LEVESQUE DATE: 1/01		KING COUNTY DEPARTMENT OF NATURAL RESOURCES
BASE MAP PLOT: E. Mac kINNON			PROJECT ECOLOGIST: R. SCHAEFER DATE: 1/01		PAM BISSONNETTE, DIRECTOR
DESIGN PLOT: E. Mac KINNON			DESIGNED: A. LEVESQUE DATE: 1/01		WATER AND LAND RESOURCES DIVISION
CHECKED: A. LEVESQUE			DRAWN: J. SMALL DATE: 1/01		FENSTER REVETMENT REPAIR
DATUM: NAVD 88					RIVER MILE 32.0
BY DATE	REVISION	BY DATE			PLANTING PLAN

SHEET 6 OF 7 SHEETS

RIVERS SECTION

PLANTING SCHEDULE

Total Plants By Species		Common Name	Species Name	Typical Pot Size	Approx. Spacing	Lower Bank	Middle Bank	Upper Bank
			TREES					
35		Bigleaf Maple	Acer macrophyllum	1 gallon	10'+		10	25
35		Red Alder	Alnus rubra	1 gallon	6'+		10	25
60		Oregon Ash	Fraxinus latifolia	1 gallon	6'+	50	10	
10		Sitka Spruce	Picea sitchensis	1 gallon	10'+		10	
40		Black Cottonwood	Populus trichocarpa	1 gallon	6'+	30	10	
25		Bitter Cherry	Prunus emarginata	1 gallon	6'+			25
25		Douglas Fir	Pseudotsuga menziesii	1 gallon	10'+			25
40		Western Crabapple	Pyrus fusca	1 gallon	6'+	30	10	
25		Cascara	Rhamnus purshiana	1 gallon	6'+			25
35		Western Red Cedar	Thuja plicata	1 gallon	6'+		10	25
25		Western Hemlock	Tsuga heterophylla	1 gallon	6'+			25
Total Trees	**355**				**TOTAL**	**110**	**70**	**175**
			SHRUBS					
50		Serviceberry	Amelanchier alnifolia	1 gallon	4'+			50
65		Red-osier Dogwood	Cornus stolonifera	1 gallon	4'+	50	15	
50		Western Hazelnut	Corylus cornutus	1 gallon	4'+			50
65		Black Hawthorn	Cratageus douglasii	1 gallon	4'+		15	50
50		Oceanspray	Holodiscus discolor	1 gallon	4"+			50
65		Black Twinberry	Lonicera involucrata	1 gallon	4"+	50	15	
50		Indian Plum	Oemleria cerasiformis	1 gallon	4'+			50
65		Pacific Ninebark	Physocarpus capitatus	1 gallon	4'+	50	15	
50		Red Flowering Current	Ribes sanguineum	1 gallon	3'+			50
65		Nootka Rose	Rosa nutkana	1 gallon	3'+		15	50
65		Baldhip Rose	Rosa pisocarpa	1 gallon	3'+		15	50
50		Thimbleberry	Rubus parviflorus	1 gallon	4'+			50
30		Salmonberry	Rubus spectabilis	1 gallon	4'+		30	
535		Red Elderberry	Sambucus racemosa	1 gallon	2'+		160	375
115		Snowberry	Symphoricarpos alba	1 gallon	4'+		15	100
Total Shrubs	**1370**				**TOTAL**	**150**	**295**	**925**

SURVEYED: J. SMALL & K. ZWEIG
BASE MAP PLOT: E. Mac KINNON
DESIGN PLOT: E. Mac KINNON
CHECKED: A. LEVESQUE
DATUM: NAVD 88

BY DATE

REVISION BY DATE

PROJECT MANAGER: A. LEVESQUE DATE: 1/01
PROJECT ECOLOGIST: R. SCHAEFER DATE: 1/01
DESIGNED: A. LEVESQUE DATE: 1/01
DRAWN: J. SMALL DATE: 1/01

KING COUNTY DEPARTMENT OF NATURAL RESOURCES
PAM BISSONNETTE, DIRECTOR
WATER AND LAND RESOURCES DIVISION
FENSTER REVETMENT REPAIR
RIVER MILE 32.0
PLANTING PLAN